ARCHIVES of OPHTHALMOLOGY

VOLUME 4 (old series Volume 61) OCTOBER, 1930 NUMBER 4

THE RELATION OF TEETH TO DISEASES OF THE EYE*

W. H. WILMER, M.D., LL.D., Sc.D.
BALTIMORE

Odontology is of ancient lineage. Fifteen hundred years before Christ, diseases of the teeth were mentioned in Eber's papyrus. Among the early Egyptians, dentists were numerous, for Herodotus says:

> Physicke is so studied and practiced with the Egyptiens that every disease hath his several physicians, who striveth to excel in healing that one disease and not to be expert in curing many. Whereof it cometh that every corner of the country is full of physicians. Some for the eyes, others for the head, many for the teeth, not a few for the stomach and the inwards.

The Etruscans, according to Garrison,[1] were highly skilled in dentistry, and he quoted Martial in regard to the excellence of their bridgework.

Early in the Christian era, the teeth had their own patron saint, Saint Apollonia, who was a protectress not only of those who suffered from toothache but also of those whose duty it was to give relief (fig. 1, St. Apollonia). About the same period, Saint Lucia was regarded as the patron saint of the eyes (fig. 2). Figure 3 represents Saint Lucia and Saint Apollonia together, showing the early association of eyes and teeth. In fact, in certain portions of England, Saint Lucia was also the patron saint of the teeth.

Aetius of Amida (sixth century A. D.) gave an account of many diseases, his description of the diseases of the teeth and the eyes being the best up to that date.

According to Kanner,[2] the Talmud tells of an astronomer who bragged much about his knowledge of the stars. Whereupon the good Rabbi Gamaliel asked him: "How many teeth have you?" The boaster, confused, began to count them. The Rabbi exclaimed: "You do not even know what you have in your own mouth. How in the world do you expect to know what is in the sky?"

---

* Submitted for publication, May 19, 1930.

* Read by invitation before the Maryland State Dental Society, May 6, 1930.

* From the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital.

1. Garrison, F. H.: History of Medicine, Philadelphia and London, W. B. Saunders Company, 1922.

2. Kanner, Leo: The Folklore of the Teeth, New York, The Macmillan Company, 1926.

Fig. 1.—Saint Apollonia, the patroness of toothache and dentistry (Folklore of the Teeth, Leo Kanner).

Fig. 2.—Saint Lucia, patroness of the eyes (Crivelli).

Eustachius, that phenomenal investigator (about 1563), among his other great accomplishments described the optic nerve and wrote a remarkable treatise on the teeth ("Libellus de dentibus").

According to Cahn,[3] about two hundred years ago Fabricus Hildanus recorded a case of ophthalmia with loss of the eye as the result of a dental abscess.

Pierre Fauchard, in the second edition of his book ("Le chirurgien dentiste," 1746), gave the first description of pyorrhea alveolaris.

Fig. 3.—Saint Lucia and Saint Apollonia (author's collection).

One of the masterpieces of John Hunter was his "Natural History of the Human Teeth" (1771), the pioneer in the scientific study of the teeth. He classified them according to their present terminology, and he strongly advised the removal of the pulp in filling cavities.

Benjamin Rush (1745-1813), among his overwhelming labors, studied the relation of teeth to the general health and advised the extraction of those that were decayed.

3. Cahn, Lester R.: Oral Sepsis in Relation to Eye, Ear, Nose and Throat Diseases, New York M. J. **118**:168 (Aug. 1) 1923.

Between 1840 and 1845, Sir Richard Owen, son-in-law of John Hunter's secretary, published a remarkable treatise on the comparative morphology of the teeth of living animals ("Odontography").

History is replete with superstitions concerning the teeth, their position, shape, color, aches and remedies. The accounts from uncivilized countries of voluntary deformation of teeth are very interesting; and so are the records of their use as tools, surgical instruments, charms, amulets, relics, ornaments and objects of worship. The Siamese are said to have once offered a Portuguese 700,000 ducats to redeem the sacred tooth of a monkey.[4] All through the early periods of history, there is much evidence of the appreciation of teeth as objects of beauty and usefulness. Cervantes, through Don Quixote, vividly expressed this when he made the "valorous knight" exclaim: "A diamond is not as precious as a tooth."

But the relation of teeth to sight was only beginning to be recognized in 1795, when Richter[5] reported the instance of a woman, blind for several years, who regained her sight after the extraction of a tooth. Twenty-two years later, Beer[6] stated that a consensual nerve disease of the eye can be produced by a carious tooth. In tracing the gradual recognition of the connection between the teeth, special organs and the general health, it is interesting to ophthalmologists of Maryland to note here the fact that the world's first dental college was founded in Baltimore in 1839, and opened for students in 1840 (fig. 4). In 1843 Koecker[7] reported a case in a woman whom he had seen three years previously. Her vision was so impaired that she could not see her way by herself. Her mouth was in a foul condition. The remaining teeth were extracted and the gums treated, and in three years vision had improved so much that the woman could go anywhere alone. In 1859, Hancock[8] reported two cases of blindness and one of ptosis with divergent squint, cured by the removal of decayed and infected teeth. In 1865, that incomparable observer, Jonathan Hutchinson,[9] called attention

4. Brewer, E. C.: Dictionary of Phrase and Fable, Philadelphia, Henry Altemus Company, 1894.

5. Richter, A. G.: Anfangsgründe der Wundarzneikust, Göttingen, J. C. Dieterich, 1795.

6. Beer, G. Joseph: Lehre von den Augenkrankheiten, Vienna, Huebner & Volke, 1817.

7. Koecker, Leonard: Report of a Case of Lost Sight Cured by Proper Dental Treatment, Am. J. Dent. Sc., June, 1843.

8. Hancock, Henry: Two Cases of Amaurosis Depending on Dental Irritation; A Case of Ptosis and Diverging Strabismus from Decayed Teeth, Dental Cosmos, August, 1859.

9. Hutchinson, Jonathan: A Group of Cases Illustrating the Occasional Connexion Between Neuralgia of the Dental Nerves and Amaurosis, Ophth. Hosp. Rep., 1865.

to the fact that infantile paralysis occurs often during the period of dentition, and he reported cases of blindness relieved by the extraction of bad teeth. He added: "I believe we pay far too little attention to the state of the teeth as possibly productive of disturbances of function or nutrition in the eyeball, or even in the cerebral center of vision."

In 1885, Schmidt-Rimpler [10] mentioned diseased teeth as the cause of weakness of accommodation and of increased intra-ocular tension in glaucoma.

Until twenty-five years ago, from time to time a voice, like "one crying in the wilderness," would call attention to the rôle of teeth in the causation of diseases of the eye. But, as is often the case, this voice

Fig. 4.—Baltimore College of Dental Surgery (1840), the first dental college in the world (S. A. Tiernan, Hygiea).

was not heeded. Textbooks on the eye gave as the cause of many eye lesions syphilis, rheumatism, gout and idiopathy. The teeth and other foci of infection were not mentioned.

In spite of the fact that several colleagues abroad feel that American ophthalmologists overrate the influence of teeth as a focus of infection, reports now appear from all parts of the world on the teeth as a cause of ocular lesions. For instance, in a splendid article in 1913, Lang [11] analyzed the cause of 385 inflammatory conditions of the eye in a list of

10. Schmidt-Rimpler, H.: Augenheilkunde und Ophthalmoskopie, Marburg, Friedrich Wreden, 1885.

11. Lang, William: The Influence of Chronic Sepsis upon Eye Disease, Lancet **1**:1376 (May 17) 1913.

10,000 patients. These patients suffered from various forms of inflammation of the uveal tract and the episclera. In 139 of these cases, the diseases were due to pyorrhea alveolaris.

In the same year, Seydel [12] analyzed the connection between the teeth and the eyes. He said, however, that the assumption of a close relation between the two by the term "eye tooth" is based more on popular imagination than on clinical observation. But he lays stress on the involvement of the orbit from infected teeth in the form of lymphangitis or thrombophlebitis.

In 1918, Steinbugler [13] reported the result of two years' work on the relationship of the teeth and the eye in the Herman Knapp Memorial Hospital. Fifty-three cases were analyzed. Of these, thirty-two showed an involvement of some portion of the uvea, four detached retina, four episcleritis, one retrobulbar neuritis and the others scattering diseases. Fifty-two of these fifty-three patients showed an infection of the teeth on the same side as the affected eye. The author therefore concluded that this indicated an infection through the lymphatics or by means of openings in the bone rather than through the blood stream.

The importance of the teeth in their relation to good health is being recognized more and more, and the reports concerning the relation of diseases of the eye to oral sepsis are increasing in number. I can only touch the surface and I cannot hope to add anything new. Recently I attended the celebration of the hundredth birthday of the Tennessee Medical Society. In each room in the hotel in Nashville, there was a radio loud speaker over the door. Late on the afternoon of my arrival, I was much interested in a talk about the care of the teeth, broadcast from the Gorgas Memorial, Washington, D. C. A few days later, I saw the announcement of a large grant to the Yale Medical School for the comprehensive study of the teeth in their relation to health. I have been informed that a course of lectures has been given in Philadelphia on oral sepsis in relation to conditions of the eye, and that a similar series is contemplated at the Baltimore College of Dental Surgeons. In fact, the close relation between teeth and good sight has reached the stage of being recorded by the wit and skill of the cartoonist, a final evidence of widespread interest and the importance of the subject.

Among my records there are many cases of diseases of the eye caused by diseased teeth, but I will mention only three.

The first illustrates the fact that a choroidal exudate caused by diseased teeth may be sufficiently extensive to displace the retina; the second, that a surgically clean mouth is very important even in the case

12. Seydel, F.: Connection Between Ocular Diseases and Inflammatory Conditions of the Teeth, Deutsche Monatschr. f. Zahnh. **30**:423 (June) 1912.

13. Steinbugler; Levy, and Pease: Dental Infection in Eye Diseases, Arch. Ophth. **47**:182, 1918.

of a slight operation, and the third, that only a few remaining teeth may still be dangerous if they are diseased. These cases were observed over ten years ago and there has been no return of the uveal inflammation.

REPORT OF CASES

CASE 1.—Miss L. B., aged 52, when first seen, on Oct. 16, 1919, complained of impaired vision in the left eye. Ten months before, while in a train, she noticed peculiar vertical lines before the affected eye. This disturbance rapidly grew worse, and for nearly a week vision in that eye was practically gone. A competent oculist made a diagnosis of detached retina. Since that period the sight had improved somewhat. With correction, vision in the right eye was 20/15, and in the left eye 20/40 +. In the right eye the visual field was normal, and in the left eye the blind spot was enlarged. In the upper temporal quadrant a large, irregular absolute

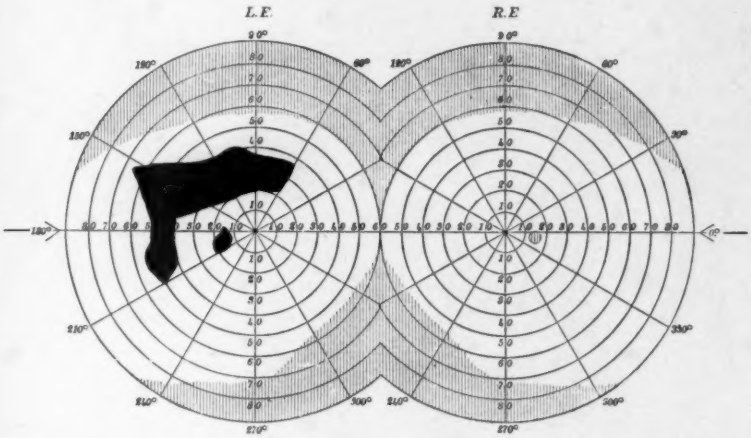


Fig. 5.—Case 1 (L. B.): Visual fields on Oct. 16, 1912. In the left eye there was exudative choroiditis. Vision was 20/40.

scotoma was observed (fig 5). Ophthalmoscopic examination revealed a normal fundus in the right eye; in the lower nasal portion of the fundus of the left eye there was a large plaque of exudative choroiditis, lifting the retina above the rest of the fundus. The medical examination gave negative results except that two teeth were observed that had apical abscesses with pyorrhea pockets on each side. These teeth were extracted, and treatment was given for the shallow pyorrhea involving other teeth. Local treatment of the eye consisted of hot applications and ethylmorphine hydrochloride. Improvement in vision was noticed within two weeks. On December 19, the patient reported that she was entirely unconscious of the eye. The central and peripheral vision were normal, and they remained so (fig. 6).

The fact that all examinations yielded negative results except the infected teeth and the quick recovery after their extraction lead one to believe that the diseased teeth were the cause of the choroiditis.

CASE 2.—G. W. R., aged 69, when seen on Nov. 11, 1911, had had a defective right eye for several years (complicated cataratct with calcareous degeneration

of the capsule). In the left eye, a cataract was extracted successfully four years previously. About one month before examination, he noticed that the sight in this eye was growing dimmer. Examination of the eye revealed a thickened capsule. A thorough survey was made, and it was reported that there was general arteriosclerosis, increased blood pressure and slight deficiency in kidney function. His dentist reported that the "mouth from a surgical standpoint was 100 per cent normal." (Later it was discovered that only a clinical examination was made, and that the teeth were not examined roentgenolographically.) On December 13, a discission was carefully made in the capsule. All went well until the late afternoon of the fourth day, when it was noticed that there was decided pericorneal injection, with deposits of punctate keratitis on the cornea, and slight hypopyon. In brief, there was a mild iridocyclitis with normal intra-ocular tension. As this was the patient's only useful eye, and he was in the midst of some important work, I was concerned about him. In hunting for a possible cause for this complication,

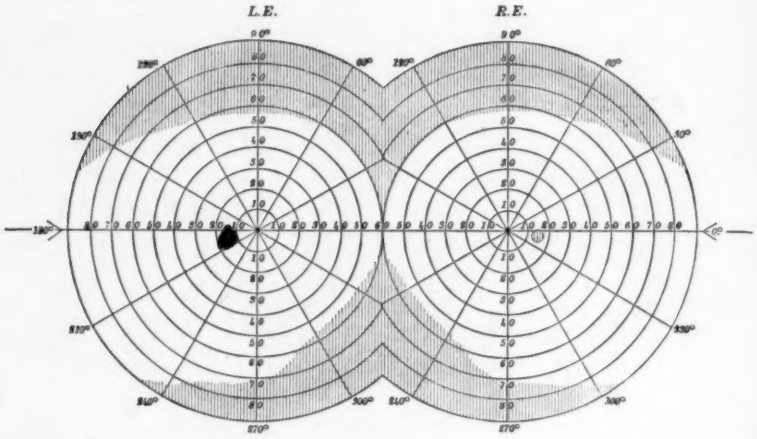


Fig. 6.—Case 1: Visual fields on Feb. 11, 1920, four months after the removal of infected teeth. Vision was 20/15.

I discovered some swelling over the root of the upper first biscuspid of the same side as the affected eye. There was also considerable tenderness on pressure. Unfortunately, it was late on Saturday afternoon, and there was little opportunity of getting a dentist to see the patient before Monday morning. I therefore took a short, stout cataract knife and plunged it into the swollen gum, making a half revolution of the blade. I was much relieved to see thick pus oozing out. The abscess cavity was irrigated at intervals until Monday morning, when the offending tooth was extracted. Within forty-eight hours after the abscess was drained, the eye began to improve. By the end of ten days, the eye was normal in appearance, with good sight.

Case 3.—E. G., a man, aged 57, consulted me first on Oct. 6, 1919. His family history and general medical history were irrelevant. In 1898, he noticed before the left eye a dusty spot, which he saw for years. In 1910, he could not see certain familiar constellations (e.g., "the Wagoner"). In 1913, he could not see a squash ball. During 1914, many consultations were held. No cause for the trouble was found. He was told that the trouble with the eyes came from tobacco, though the patient smoked moderately. He had not been able to read

for a year preceding examination. Vision was better by dim light. The patient laughingly added: "There is one thing that we can certainly exclude—the mouth —for I have only about three teeth left." Ocular examination showed: vision in the right eye, 5/200; in the left eye, 4½/200 (eccentric). With each eye using

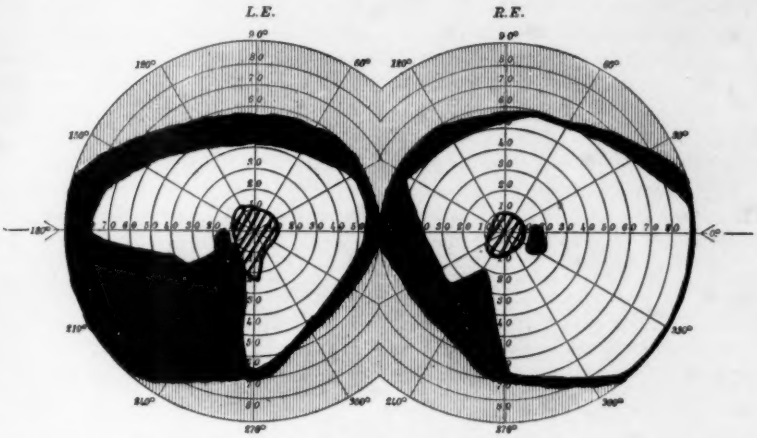


Fig. 7.—Case 3: Visual fields in a case of disseminated chorioretinitis on Oct. 6, 1919. Vision was 4½/200 in the left eye and 5/200 in the right.

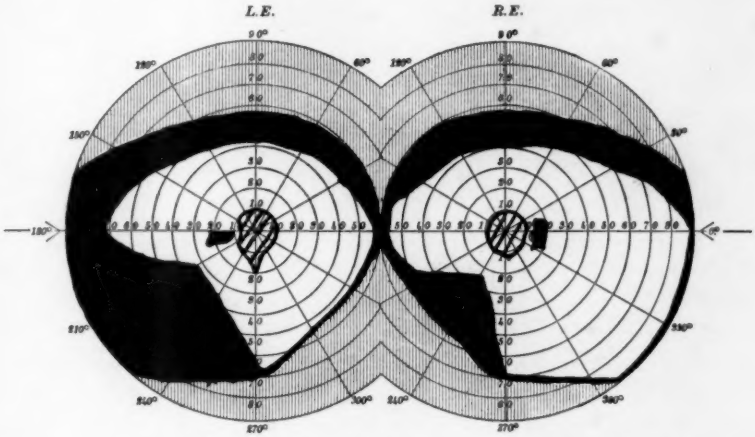


Fig. 8.—Case 3: Visual fields on Dec. 10, 1929. Vision was 20/200 in each eye.

sphere +3.0, he could read Jaeger-14 at 6 inches (15.2 cm.); using sphere +20.0, Jaeger-2 at 4 inches (10.1 cm.) in bright light. The print was seen more readily in a dim light or by the addition of a tinted glass. The patient used central vision in bright light, or paracentral vision in a dim light. Examination of the visual fields (fig. 7) revealed: in the right eye, a marked inferior temporal quadrant defect, central scotoma, relative for white but absolute for colors and an enlarged blind spot; in the left eye, similar conditions were observed, but the peripheral

field defect was inferior nasal. Ophthalmoscopic examination showed the media clear, and the disks a trifle pale with slight blurring of the margins. The size of the vessels was normal; a slight venous pulsation was seen. Scattered over the fundus, around the nerve and the macular region in each eye were spots of chorioretinitis. The proliferation of the retinal pigment epithelial cells and the migration of pigment granules, were marked features, the spots simulating the appearance of retinitis pigmentosa. Light sense (threshold) was much reduced. A medical examination gave negative results. The spinal fluid showed a slightly increased globulin content. Dental examination revealed a large apical abscess of the superior left molar; the lower left bicuspid was similarly involved. There was much absorption of the alveolar process. The infected teeth were extracted and treatment was given for pyorrhea. Local treatment for the eye consisted of the administration of ethylmorphine hydrochloride and hot applications.

On Dec. 10, 1919, vision was 20/200 in the right eye and 20/200 in the left. With sphere +20 in bright light he could read Jaeger's test type no. 1 at 5 inches (12.7 cm.) with each eye, and with sphere + 10, in dim light, at 6 inches with each eye. Examination of the visual fields showed the peripheral contractions slightly improved (fig. 8). The patient noticed that the central blind spots seemed less dense and that they covered a smaller area in the visual fields. The condition appeared to be extensive chorioretinitis of long standing from infected teeth.

COMMENT

One gathers from the mass of data in many languages that there is no tissue of the eye that is immune to disease from diseased teeth. Therefore, I will take up briefly the special structures of the eye.

As early as 1908, Bonsignorio [14] and Higgs [15] mentioned corneal disturbances as a result of diseased teeth. A year later, Brinton [16] wrote to the same effect. In 1918, Steinbugler [13] reported the following cases of corneal involvement resulting from diseased teeth: one dendritic and one interstitial keratitis, one vesicular and one kerato-iritis. Bishop Harman [17] advanced the theory that there is a causal relation between the deciduous teeth and the phlyctenules of the cornea and conjunctiva. He suggested that the lesion is a form of herpes appearing in poorly nourished children as a result of decay of the "milk teeth," which causes a peripheral irritation in the distribution of the second division of the fifth nerve. But other observers do not agree with this opinion (Seydel [12]). Back [18] said that diseased teeth harbor the virus of herpes which spreads along the trigeminus to the cornea. MacCallan [19] felt that dendritic ulcer of the cornea is closely associated with infected teeth.

---

14. Bonsignorio, R. A. C.: Affections oculo-dentaires chez les nourissons, Clin. Opht., April 25, 1908.

15. Higgs, A. K.: Ocular Disturbances the Result of Dental Disease, J. Ophth., Otol. & Laryng., April, 1908.

16. Brinton, A. G.: Irritation of the Trigeminus, Ophth. Rev., October, 1909.

17. Harman, N. Bishop: The Conjunctiva in Health and Disease, New York, William Wood & Company, 1905, p. 209.

18. Back, Heinrich: Relations of Chronic Septic Affections of the Teeth to Disorders of the Eye, Dental Cosmos **71**:388 (April) 1929.

My old teacher, Dr. Emil Gruening, as long as forty years ago, called attention to the fact that this corneal disease frequently came from infected teeth. I have seen many instances in which ignorant people still hold to the great therapeutic value of saliva in diseases of the eye, and have infected the eye accordingly. However, I have not seen any deep lesions in the cornea, such as interstitial keratitis, that I could attribute to the teeth alone, though such cases have been reported by competent observers.

Ophthalmologists (MacCallan [19]) have found a connection between episcleritis and infected teeth. Steinbugler [13] reported two cases. According to my own experience, teeth alone do not play a very important part in inflammation of this tissue, but they have a contributing influence in association with some other foci, such as sinuses and tonsils, or, when some toxemia, such as tuberculosis, is present.

The uveal tract, according to observers generally, is the site of the majority of the ocular lesions that result from diseased teeth. The three cases that I have reported are examples. Bulson [20] found that 32 of 100 cases of iritis were due to diseased teeth. Irons and Brown [21] found that out of their series of 200 cases of iritis, 12 cases were caused by the teeth alone and 15 by the teeth in association with other sources of infection. In 1926 Elschnig [22] reported that in 12 of 29 cases of iridocyclitis, alveolar pyorrhea and apical abscesses were the cause. From all countries there are reports of iridocyclitis and choroiditis due to infected teeth. A number of these cases followed the extraction of infected teeth. Parsons,[23] in the last edition of his book on diseases of the eye, said, in regard to iridocyclitis: "The septic focus is most frequently found in the mouth—pyorrhea alveolaris—in the nose and accessory nasal sinuses, or especially in women, in the genital tract."

The retina, owing to its close connection with the choroid, suffers in choroidal involvement.

The lens, in its homogeneous capsule, devoid of blood vessels and nerves, might seem removed from possible danger from diseased teeth. But this very isolation indicates a precarious source of nutrition, especially in lesions of the uveal tract. The lens metabolism is very delicate and not well understood. In the later decades of life, cataract is very

19. MacCallan, C. B. E.: Toxic Absorption Due to Focal Septic Lesions, Eye, Ear, Nose & Throat Monthly **8**:25 (Feb.) 1930.

20. Bulson, A. E., Jr.: Etiology and Treatment of Endogenous Iritis: Analysis of 100 Private Cases, Tr. Am. Ophth. Soc. **23**:292, 1925.

21. Irons, E. E., and Brown, E. V. L.: The Etiology of Iritis, J. A. M. A. **66**:1840 (June 10) 1916; **81**:1770 (Nov. 24) 1923.

22. Elchnig, A.: Etiology of Iridocyclitis, Klin. Monatsbl. f. Augenh. **75**:130, 1925.

23. Parsons, Sir John Herbert: Diseases of the Eye, New York, The MacMillan Company, 1930.

common. It is logical to believe it possible that a toxic substance from the teeth might upset the nutrition of the lens and its delicately balanced metabolism, with a resulting loss of transparency or cataract. In this connection, MacCallan [19] said: "I believe that the most important cause of cataract formation is the presence of long continued focal sepsis, generally dental." It is a daily experience to see patients with cataract suffering from dental sepsis, and I have often felt that the teeth were a factor, but I have never been able to prove this.

The vitreous, likewise, is dependent on a distant blood supply for its nutrient lymph. Opacities are often discovered when there are no other visible ocular lesions, particularly in older people with poor teeth. In such cases I have often seen improvement after the removal of the offending teeth and the use of local stimulating treatment.

Many observers have noted the relation of diseased teeth to diseases of the optic nerve. White [24] found 30 per cent of forty-six cases of disturbance of the optic nerve due to the teeth. In 44 per cent of my own series of eighteen cases of retrobulbar neuritis, the teeth, associated with diseased tonsils and sinuses, seemed to have been a contributing cause of the lesion.

Cysts of the meibomian follicles, according to MacCallan [19] are frequently associated with dental sepsis in all classes of patients. He also quoted Lang in saying that primary glaucoma has its origin in focal sepsis.

Orbital cellulitis has been found by many observers (Vossius,[25] Dagilaiski,[26] Telepnew [27] and others) to arise from dental infection. I have seen several cases of orbital abscess from infection of the antrums through the teeth.

Various other diseases have been noted in connection with diseased teeth; for instance, conjunctivitis (Calhoun [28] and others), progressive myopia (MacCallan [19]), blepharospasm (de Coopman [29]), squint and ptosis (Hancock [8]), and mydriasis (Verrey [30]). The teeth have to bear

24. White, Leon E.: The Location of the Focus in Optic Nerve Disturbances from Infections, Ann. Otol., Rhin. & Laryng. **37**:128, 1928.

25. Vossius, A.: Ein Fall von Orbitalphlegmone bei Thrombophlebitis der Orbitalvenen nach Extraction eines kariösen Backzahnes mit Ausgang in Heilung und Erhaltung des Bulbus sowie des Sehvermögens, Arch. f. Ophth. **30**:3, 1884.

26. Dagilaiski, W.: Ueber Orbitalphlegmone dentalen Ursprungs, Klin. Monatsbl. f. Augenh., 1899.

27. Telepnew, N. A.: Ein Fall von Phlegmone der Orbita dentalen Ursprungs, Ztschr. f. Augenh., 1912, vol. 27.

28. Calhoun, J. G.: Membranous Conjunctivitis, Am. J. Ophth., 1911, vol. 28.

29. De Coopman, L. E. J.: Ein Fall von Blepherospasmus, anscheinend infolge des durchbrechens eines Zahnes, Ophth. Klin., XI, 1905, vol. 11.

30. Verrey, Louis: Un cas de mydriase unilatérale d'origine dentaire: Evolution retardée de la dente sagesse, Ann. d'ocul., 1912, vol. 147.

the blame for many diseases of the eye, perhaps, in some cases, with injustice.

Various degrees of impaired vision, up to complete blindness, have been reported by observers (Sloggett,[31] Sterling,[32] Dor [33]) as a reflex neurosis from the teeth. I have seen one case of marked amblyopia in one eye seemingly dependent on an impacted molar. The patient, a dentist, made his own diagnosis and came to me only to have his opinion verified. The vision became normal in forty-eight hours after removal of the offending tooth. In this connection MacKenzie's [34] remarks about the trigeminal as an integrating mechanism in diseases of the teeth are very timely. He stated that when diseased teeth give rise to ocular lesions, he believed that the neural energy, dispersed in the cerebral direction, selects the eye because of the refinement and delicacy of its structure. He added that the control of nutrition has a close relation to painful stimuli.

The ocular diseases that arise from the teeth belong to two separate classifications: reflex neuroses and inflammatory or degenerative changes in the various structures of the eye.

In the first group, the disturbance in the functions of the eye comes through the nervous apparatus from irritation of the dental branches of the trigeminus, such as amblyopia without visible changes in the fundus; blepharospasm; paralysis of the external eye muscles; mydriasis; asthenopia, neuralgia, etc.

In the second division, there are definite organic lesions of the essential tissues of the eye which may occur in different ways: (1) metastatic bacterial invasions; (2) toxemia resulting from the disintegration of the micro-organisms themselves or of their capsular envelopments, through the blood stream; (3) direct extension from the infected teeth to the orbit; (4) direct transference from the mouth to the eye, usually by the fingers; (5) infection through the intestinal tract from material swallowed; (6) extension of the virus along the nerves from the first to the second branch of the trigeminal, as in the case of herpes of the cornea; (7) a local manifestation of an allergic reaction, and (8) transmission along the lymphatic vessels. Because many observers find the eye lesion usually on the same side as the dental infection, they consider the lymphatics as the chief route of transmission. However, it is difficult to conceive why the lymph capillaries, with their lining of endothelial cells, should absorb the bacteria or their toxins more readily than the

31. Sloggett, H. C.: Case of Reflex Amaurosis, Ann. Ophth., April, 1900.

32. Sterling, J. W.: Bilateral Amaurosis Following Severe Hemorrhage After Extraction of Tooth; Partial Recovery, Ophth. Rev., 1904.

33. Dor, Louis: Die Augenzahne, Ophtal. provinc., no. 4, 1910.

34. MacKenzie, Ivy: The Trigeminal System as an Integrating Mechanism in Disorders of the Eye, Tr. Ophth. Soc. U. Kingdom, 1924.

vascular system. The lymph nodes are supposed to give some protection to the organism from infection; but in doing this, they themselves become enlarged and inflamed. Yet many serious ocular lesions occur from dental sepsis without any recognizable change in the lymph glands. Even if the primary absorption of infectious material takes place through the lymph vessels, the virus finally gains access to the eye through the vascular system when the contents of the lymph vessels, after transversing several lymph nodes, are discharged into the veins.

The following are some of the dental conditions that may give rise to ocular inflammations: (1) apical abscesses, (2) pyorrhea alveolaris, (3) septic, broken roots, (4) maxillary or mandibular infection remaining after the extraction of diseased teeth, (5) impacted, infected teeth, (6) pulp stones and (7) degenerating pulp of an anomalous extra root, from a nutritive disturbance following traumatism. This condition is easily overlooked, because the roentgenograms may fail to show the anomaly, the other root or roots may be normal and the tooth may seem to be well vitalized.

The more common micro-organisms found by culture from infected teeth accompanied by ocular lesions are: (1) *Streptococcus viridans* and *hemolyticus,* (2) *Staphylococcus albus* and *aureus,* (3) pneumococcus and (4) *Bacillus pyocyaneus.* The work done by Rosenow and also by Haden on the elective localization of bacteria from infected teeth is interesting and deserves further investigation, for some observers have not been able to obtain similar results (Back [18]).

SUMMARY

1. In my opinion, the importance of the teeth in relation to ocular diseases is shown by the fact that my survey blank calls for investigation of the teeth among the first examinations:

Survey

Nose and throat; dentistry; x-ray of sinuses, optic foramina, chest, gallbladder, gastro-intestinal tract, skull and sella turcica; basal metabolism; blood chemistry; blood pressure; urine; kidney function; stool; tuberculin; blood; spinal fluid; medical; gynecological or genito-urinary; neurology.

2. A clinical examination of the teeth is not sufficient. In many serious ocular lesions, roentgenograms should be taken of all the teeth. Even then, pus pockets or a degenerating pulp in an anomalous root may be overlooked.

3. Crowned, devitalized, badly discolored and pulpless teeth should be under suspicion in patients who have a chronic uveal inflammation.

4. Occasionally the extraction of badly infected teeth seems to cause for a short time a temporary exacerbation of the ocular inflammation, and occasionally serious eye complications have followed.

5. In many cases of serious inflammation of the eye, infected teeth may be associated with other foci of infection, such as the sinuses and tonsils. In such cases it is impossible to say just how much the teeth have contributed to the cause of the eye lesion, but their evil influence should be removed.

6. Even when a definite general toxemia exists, as in the case of syphilis and tuberculosis, the patient should be treated for sepsis of the mouth, because the general toxemia seems to sensitize the eye tissues to infection existing in even distant foci.

7. The great preponderance of lesions of the very vascular uveal tract resulting from dental sepsis suggests the blood stream as a definite means of transmission of infection to the eye.

8. The ocular lesions from dental sepsis may be the result of a slow and general sensitization of the delicate eye tissues to the diluted or nonvirulent bacteria or their toxic substances rather than a sudden overwhelming infection. In this connection, the work done by Julianelle [35] recently on the "Development of Eye Reactivity to Derivatives of Pneumococci" is most interesting. Among his other conclusions, he finds that following the injection of dead pneumococci into the skin a special kind of "eye" and "skin" sensitiveness is produced. "This seems not to be related to the presence of circulating antibodies." On the other hand, in the case of a violent inflammation in the eye following the extraction of several badly diseased teeth, the lesions seem to come from a sudden liberation of bacteria or a large amount of toxic substance into the blood stream.

9. In addition to my own experience, the reports of reflex ocular neuroses of dental origin are too numerous to admit of any doubt of their existence.

10. The laboratory proof of pathogenic micro-organisms in the affected eyes of patients suffering from dental sepsis has not been found; but from the hundreds of clinical observations reported, one must believe that infected teeth and many ocular inflammations have a close causal relation. An ophthalmologist who does not give his patient the advantage of these observations fails in his full duty, irrespective of the metastatic or allergic theory of the origin of the ocular condition. This is particularly true before intra-ocular operations.

11. The proper care of the teeth is one of the most important factors in the present day public health program and in the scheme for the conservation of vision.

---

35. Julianelle, Louis A.: Reactions of Rabbits to Intracutaneous Injections of Pneumococci and Their Products, J. Exper. Med. **51**:441, 1930.

INCLUSION BODIES IN ARTIFICIALLY INDUCED CONJUNCTIVITIS *

S. R. GIFFORD, M.D.
AND
N. K. LAZAR
Ward Fellow in Ophthalmology
CHICAGO

Since the description by Halberstaedter and Prowazek,[1] in 1907, of peculiar bodies in the epithelial cells in cases of trachoma, an extensive literature has grown up on the question of the etiologic relation of these bodies to trachoma. Halberstaedter believed they represented a living parasite, the cause of trachoma, and called them *Chlamydozoa,* or mantle protozoans. This observation was soon confirmed by many observers. Similar bodies were found in other diseases of unknown origin; in scarlet fever by Mallory,[2] in varicella by Gins,[3] and in other diseases.[4] They were regarded as either living pathogenic organisms or as the reaction products of the cells to invisible organisms or viruses. The first evidence casting doubt on the specificity of such bodies for trachoma was the report of their presence in other diseases, some of known bacterial origin. Stargardt and Heymann [5] reported finding identical bodies in conjunctivitis of the new-born infant, both with and without gonococci. Heymann found them in the urethral and cervical mucosa respectively, of the parents of children with ophthalmia neonatorum. Herzog [6] worked on the association of inclusion bodies with gonococci; he inoculated the conjunctiva of a blind human eye with cultures of gonococci, finding typical inclusion bodies in material from the resulting conjunctivitis, and was led to the conclusion that trachoma is due to a strain of gonococcus that lives as an intra-epithelial parasite. Halberstaedter [7] and Lindner [8] also found inclusions in the urethra of

* Submitted for publication, June 9, 1930.

* From the Department of Ophthalmology, Northwestern University Medical School.

1. Halberstedter and Prowazek: Deutsche med. Wchnschr., 1909, pp. 240 and 241.

2. Mallory: J. M. Research **10**:483, 1903.

3. Gins: Ztschr. f. Hyg. u. Infektionshr. **86**:299, 1918.

4. Findlay and Ludford: Brit. J. Exper. Path. **7**:223, 1926.

5. Heymann: Deutsche med. Wchnschr. **27**:1692, 1901; Berl. klin. Wchnschr. **47**: 663, 1910; Klin. Monatsbl. f. Augenh. **8**:338, 1909.

6. Herzog: Deutsche med. Wchnschr. **36**:1076, 1910.

7. Halberstaedter: Berl. klin. Wchnschr. **47**:661, 1910.

8. Lindner: Arch. f. Ohrenh. **78**: 235, 1911; ibid. **84**:1, 1913; Klin. Monatsbl. f. Augenh. **77**:555, 1926; Ztschr. f. Augenh. **57**:508, 1926.

patients with gonorrheal urethritis. Lindner also found them in the urethra in cases in which no gonococci could be found and in the vaginal canal of mothers. He concluded that cases of urethritis and conjunctivitis in which both gonococci and inclusions were present represent a mixed infection with gonococci and a hypothetical "inclusion-virus," which when present alone causes what he called "inclusion-blenorrhea" and a mild form of urethritis, so mild, apparently, as to have been entirely overlooked by urologists. With regard to the relation of the inclusions to trachoma, he later formed a theory according to which the viruses of trachoma and inclusion blenorrhea were originally identical, but the former, by repeated passage from one conjunctiva to the other, has acquired the property of producing trachoma, while the latter lives in the genital tract and produces, when transferred to the conjunctiva of the new-born, "inclusion-blenorrhea." Jancke,[9] who found inclusions in fifteen of sixteen cases of gonorrheal urethritis, was content to record this fact as evidence against the specificity of the bodies either for trachoma or for conjunctiva. The number of conditions in which inclusions were found continued to increase. Roemer found them in follicular conjunctivitis, Thierfelder, Botteri and Lodato in vernal conjunctivitis, and Axenfeld in diplobacillary conjuctivitis. Of a number of authors reporting on Swimmer's conjunctivitis, some found and some failed to find inclusions. Addario, senior, found inclusions not only in diplococcal conjunctivitis and subacute catarrhal conjunctivitis, negative for bacteria, but also on the normal conjunctiva. Addario, Jr.,[10] found them in all five normal conjunctivae examined, and concluded that they represent either the products of cellular reaction to the normal conjunctival flora or a secretory degenerative product of the epithelium which is exposed to various physical and chemical irritants. Spoto found inclusions in ten normal conjunctivae. McKee [11] found inclusions on the conjunctiva of two normal infants which he was unable to distinguish from similar bodies found in trachoma. Wolbach and McKee [12] studied material from ten cases of trachoma in sections prepared by the wet-fixation method, and compared it with material from other mucous membranes, such as the normal human appendix and the rat's small intestine. They found apparently identical inclusions in all these tissues. Halberstaedter, in taking cognizance of some of these observations (especially those of Addario) expressed himself as unconvinced by the descriptions and illustrations given of the identity of inclusions from the normal conjunctiva with those from trachoma.

9. Jancke: Deutsche med. Wchnschr. **36**:987, 1910.
10. Addario, Jr.: Arch. f. Augenh. **19**:197, 1910.
11. McKee: Ophth. Rec. **19**:292, 1911.
12. Wolbach and McKee: J. M. Research **24**:259, 1911.

Axenfeld [13] was also skeptical of Addario's observations as shown in his illustrations. In view of the repeated negative observations of Morax and others, and of Addario's later reports in which he distinguished between true inclusions found in trachoma and pseudo-inclusions, he concluded that the normal conjunctiva does not contain inclusions. (It is true that Addario's black and white cuts are not good enough to be convincing, but the photomicrographs of McKee show bodies morphologically identical with those found in trachoma.) Axenfeld seemed more convinced by McKee's observations and suggested the possibility of carriers of inclusions comparable to typhoid carriers.

Axenfeld considered carefully other possibilities as to the nonparasitic nature of the bodies. He concluded that they cannot be considered as artefact or degenerated bacteria. He described von Szily's work, which suggested that they may be broken down nuclear products from other cells deposited in or on the epithelial cells, which were shown to give similar pictures. Von Szily believed this possibility could not be excluded in considering the origin of the bodies, but Axenfeld believed that it would not explain their occurrence in an epithelium containing only otherwise healthy cells, nor the appearance of the inclusions in sections. He has examined mucus-secreting cells by special staining methods, and finds the reaction of mucin so different from that of the inclusions as to preclude their being considered as secretory products of normal cells. He thinks that the possibility of their being pathologically changed secretory products requires further proof.

The results of inoculations from trachoma and "inclusion-blenorrhea" may be briefly summarized by stating that material containing inclusions inoculated in monkeys of several species from both diseases has produced a chronic follicular conjunctivitis in many instances, usually without scar formation and never with the formation of pannus. Similar results were obtained with material not showing inclusions from the genital tract of parents whose children had "inclusion-blenorrhea." Further details are to be found in the works of Axenfeld and Lindner. The reports of Noguchi and Cohen that they had been able to grow the inclusions in cultures have not been confirmed.

After a most careful review of all the evidence, Axenfeld concluded in 1914 that the inclusion bodies of Halberstaedter and Prowazek must in all probability be considered as representing a living parasite, and that they are morphologically identical with those found in inclusion blenorrhea, but that the identity of the agent in the two diseases cannot be considered as settled. On account of certain unresolved difficulties, he believed that "we cannot speak of a decisive solution of the problem of the etiology of trachoma on the basis of the researches following those of Prowazek and Halberstaedter."

13. Axenfeld: Die Aetiologie des Trachoms, Jena, 1914.

In the years following Axenfeld's work, to which all those interested in the problem should refer for details not given here, many ophthalmologists have felt that the unsurmounted difficulties were so great that they ceased to consider the inclusion bodies as of importance in the etiology or diagnosis of trachoma. Solovieff [14] who studied material from human and experimental trachoma, considered the inclusions as probably products of nuclear disintegration. Bacteriologists and pathologists are by no means agreed in the nature of the inclusions found in this and other diseases supposed to be due to filtrable viruses. Rivers,[15] in a recent review, concluded that "under properly controlled conditions, the presence of inclusions, accepted as significant, will undoubtedly in the majority of instances be indicative of the presence of a virus in the immediate vicinity." Wolbach,[16] however, stated that the view that inclusions such as those of Halberstaedter and Prowazek are parasites is held by comparatively few pathologists and bacteriologists. He said that he believed this view to be definitely disproved. Lindner and others, however, continue to write as though there were no doubt of the parasitic nature of the bodies, and the appearance of such articles as those by Aust [17] and Taboriski [18] apparently accepting the theory of Lindner entirely, seemed to justify further work on this subject.

Dr. Kubik, of Prague, in a talk on the subject, suggested that inclusion bodies might be produced by artificially induced inflammation, and thought work of this kind had been done. No reference to it could be found however, and Rivers, in 1927, stated that "attempts to produce inclusions by artificial means have been unsuccessful." While we were considering this problem, the report by Ida Bengston [19] appeared. This author studied material from 230 cases of trachoma, in 45 per cent of which inclusions could be found. By comparison of what was considered different stages of these bodies, the conclusion was reached that they represent stages of digestion and clumping together of rod-shaped bacteria within the epithelial cells. Guinea-pigs were inoculated with a gram-negative bacillus obtained from trachoma and with other gram-negative bacilli, and in scrapings examined soon after inoculation a number of degenerated organisms were found which she considered identical with the elementary bodies and free initial bodies seen in trachoma. Only a few cells showed masses clumped around the nucleus which were somewhat similar to the inclusions of trachoma, but which she did not consider typical of them. Only one such is shown in her

14. Solovieff: Arch. Inst. Pasteur de l'Afrique du Nord **1**:388, 1921.

15. Rivers: J. Bact. **14**:217, 1927.

16. Wolbach: J. M. Research **27**:19, 1912.

17. Aust: Arch. f. Ohren-, Nasen- u. Kehlkopfh. **123**:93, 1929.

18. Taboriski: Arch. f. Ohren-, Nasen- u. Kehlkopfh. **123**:140, 1929.

19. Bengston, Ida: Pub. Health Rep. **43**: 2210, 1929; Arch. f. Ohren-, Nasen- u. Kehlkopfh. **12**:633, 1929.

photographs, and in this the granules appear larger and more widely separated than in typical inclusions. Trapezontzewa [20] had carried out similar inoculations in rabbits with a spore-bearing bacillus of low virulence, which caused a chronic follicular conjunctivitis in rabbits. Bodies were found in conjunctival scrapings which he considered identical with the inclusions of trachoma. After considering other bodies seen in epithelial cells, he concluded that the inclusions of trachoma are degenerative products of cells under the influence of a chronic inflammation.

Affanassieva [21] criticized this work, stating that his illustrations do not show characteristic inclusion bodies.

In the present work, an attempt was made to determine whether typical inclusions could be found in material from artificially induced inflammation of the conjunctiva. It seemed best to use an organism from a source entirely independent of trachoma or "inclusion-blenorrhea" and also to try the effect of chemical agents.

One organism, *Bacillus pseudotuberculosis-Rodentium,* the ability of which to produce purulent conjunctivitis in rabbits was called to our attention by Professor von Szily, was used, cultures being furnished by Docent Guist of Vienna and Professor von Herrenschwand of Innsbruck.

Rabbits and guinea-pigs inoculated with this organism showed a marked conjunctivitis from eighteen to seventy-two hours after inoculation. Several days later there was a marked folliculosis, congestion and a moderate amount of purulent discharge. This usually cleared up within a month after inoculation.

As chemical irritants, nicotine in 25 per cent aqueous solution and pure croton oil were instilled in the conjunctival sac of rabbits and guinea-pigs. Five tenths per cent of nicotine produced only slight chemosis, and no inclusion bodies were found in epithelial scrapings. A 25 per cent solution produced a well marked chemosis, followed by a conjunctivitis lasting several weeks. Epithelial scrapings were made daily for the first week and then at less frequent intervals until the inflammation subsided.

A drop of croton oil instilled in the conjunctival sac of rabbits and guinea-pigs produced a chemosis less marked than that resulting from 25 per cent nicotine. This was followed by moderately severe conjunctivitis which persisted for more than two weeks. Similar epithelial preparations were made from these animals.

Giemsa and Lindner's contrast stain were used. Pieces of conjunctiva were excised from several animals, fixed in sublimate-alcohol

20. Trapezontzewa: Arch. Inst. Pasteur de Tunis **16**:271, 1927.
21. Affanassieva: Rev. de trachome **5**:55, 1929.

and sectioned and stained by both of the foregoing methods. In such sections, intracellular inclusions of several varieties were found, but the number of forms in which these were seen made it difficult to identify any of them absolutely with the typical inclusions found in scrapings.

The figures show inclusions found in material from animals treated in various ways. Cells from "inclusion-blenorrhea" are shown for comparison.

In figures 1 and 7, from a rabbit three days after inoculation with *B. pseudotuberculosis-rodentium,* the inclusion body shown is quite typical. It stained darker than the nucleus, and was inside the cell wall and outside the nucleus. Under the oil immersion lens, the granular structure was quite distinct. Subsequent scrapings also showed similar inclusions, but these were not as typical.

In figures 2 and 8, from a rabbit two days after 25 per cent nicotine was instilled into the conjunctival sac, the inclusion is distinctly typical. Its granular structure, although not so well shown in the photomicrograph can be seen under the microscope. It forms a distinct and well marked cap and is outside the nucleus. Subsequent scrapings of this animal showed a few other quite distinct but atypical inclusions. The coccoid bodies stained pink with Giemsa stain and were probably eosinophil granules that had escaped from leukocytes.

Figures 3 and 9 are from a guinea-pig forty-eight hours after one drop of croton oil was instilled. Here, as in figure 2, the body forms a distinct cap—is included within the cell body and outside the nucleus. The granular structure is more distinct in its outer border.

Figure 4 is from a guinea-pig treated with nicotine. Although this does not appear to be typical, it forms one of a series of cell inclusions that are seen in many preparations. Their shape and structure vary, and many are connected to the nucleus by a fibrillar material which stains slightly lighter.

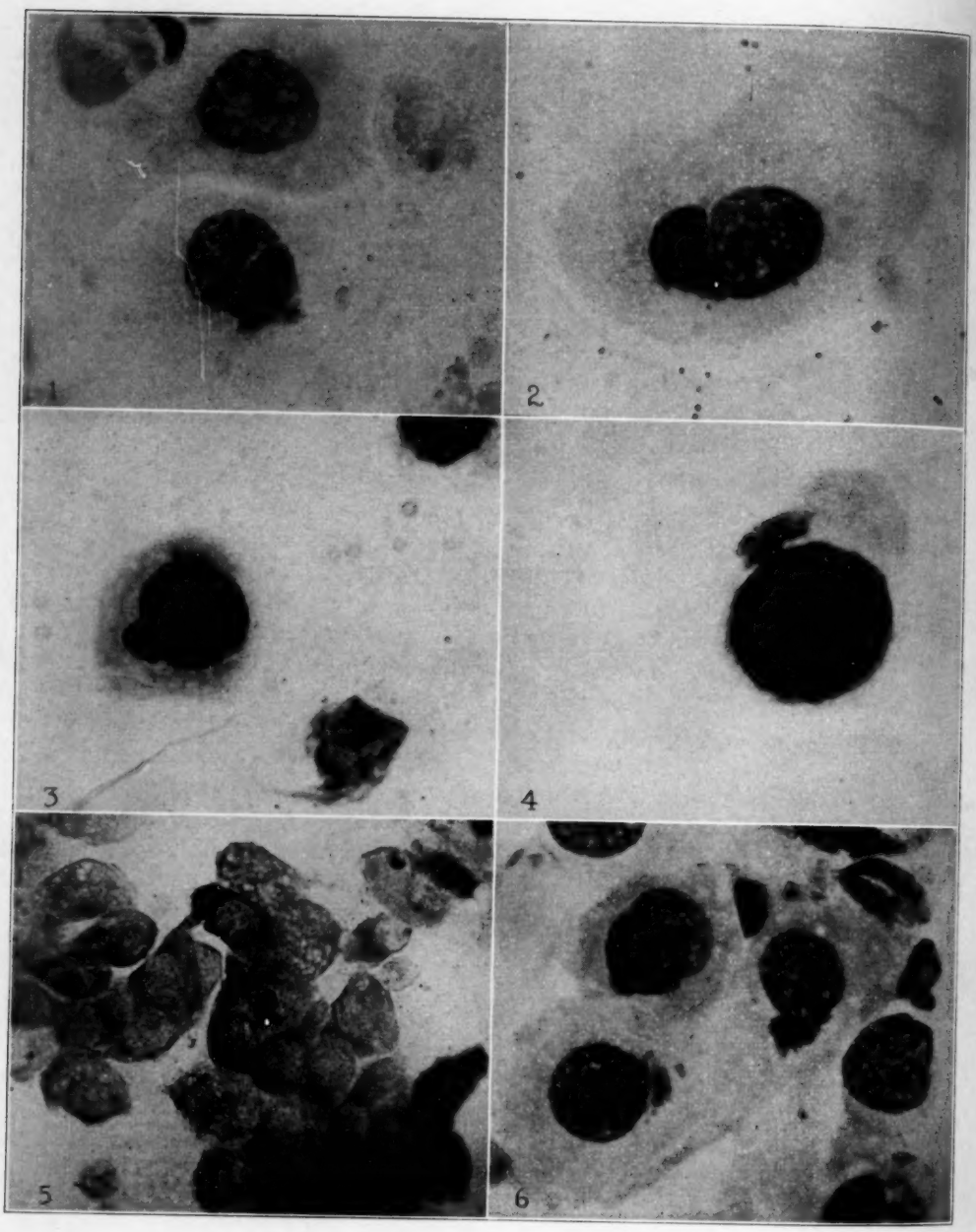
Figure 5 is from the conjunctiva of a guinea-pig treated with nicotine and stained with Lindner's contrast stain. Here the granular structure is quite apparent even in the photograph.

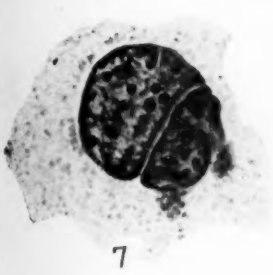
Figures 6 and 10 are from an infant with nongonorrheal conjunctivitis so-called "inclusion-blenorrhea." Two cells in the same field show typical inclusions. A third cell shows a smaller collection of granules in the cytoplasm.

A number of preparations of the normal conjunctiva of guinea-pigs and rabbits stained with Giemsa and Lindner's contrast stain failed to reveal any inclusion bodies.

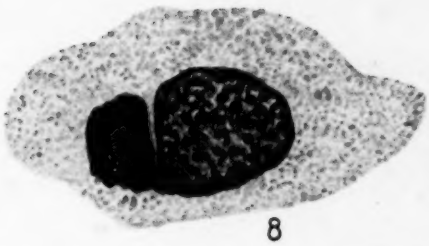
It is interesting to observe that in none of this material was anything found resembling Lindner's initial bodies.

In making a routine examination of an infant 2 months old, an epithelial scraping stained with Giemsa showed Morax-Axenfeld bacilli


1
2
3
4
5
6

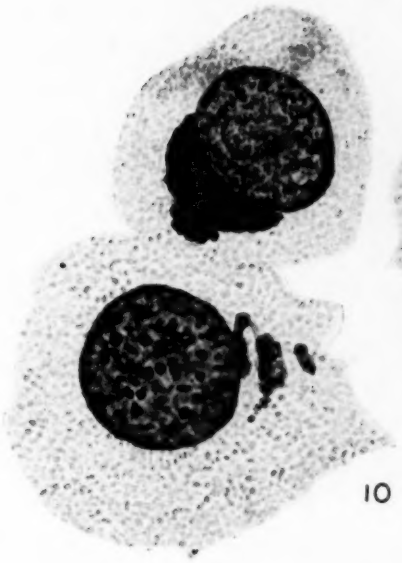


7



8

9



10

Explanation of Plates

Figs. 1 and 7.—Inclusion body produced in the conjunctiva of a rabbit by inoculation with Bacillus pseudotuberculosis-rodentium.

Figs. 2 and 8.—Inclusion body produced by instillation of 25 per cent nicotine into the conjunctiva of a rabbit.

Figs. 3 and 9.—Inclusion body produced by croton oil instilled into the conjunctiva of a guinea-pig.

Fig. 4.—Inclusion body from the conjunctiva of a guinea-pig treated with nicotine.

Fig. 5.—Lindner's contrast stain of the conjunctiva of a guinea-pig treated with nicotine.

Figs. 6 and 10.—Inclusion bodies from an infant with nongonorrheal conjunctivitis so-called "inclusion-blenorrhea."

and a cell inclusion which, although not typical, was quite granular. It was outside the nucleus, but was connected by a fibrillar structure to the body of the nucleus. Another scraping, made in a case of chronic follicular conjunctivitis of two years' duration in a negro child 9 years of age, showed a typical inclusion body.

CONCLUSIONS

1. It was possible by producing a conjunctivitis in animals with two chemical agents and an organism obtained from a source independent of trachoma and "inclusion-blenorrhea" to obtain material showing typical inclusion bodies.

2. Inclusions produced by these three agents were identical in morphology and staining reactions.

3. The fact that such inclusions were produced by chemical agents is proof that they do not represent degenerated bacteria, as was suggested by Bengston and others.

4. Such inclusions were identical in morphology and staining reactions with those found in trachoma and "inclusion-blenorrhea." While they were not found in as large numbers as is sometimes the case in the latter condition, they were no harder to find than in material from trachoma.

5. Among those who have previously reported the production of inclusions by material from sources other than trachoma or "inclusion-blenorrhea" are included the following: Herzog, who used material from the human conjunctiva after inoculation with a culture of gonococci; Trapezontzewa, from rabbits after inoculation with slightly pathogenic spore-formers; Bengston, from guinea-pigs after inoculation with gram-negative bacilli. While it seems likely that Trapezontzewa observed typical inclusions in his material, his pictures show nothing that we would consider typical. Bengston's inclusions, though resembling the initial bodies of Lindner, included only one intracellular inclusion which she did not consider a typical inclusion body.

6. The only conclusion that can be drawn from this work is that such inclusions are produced by inflammation of the conjunctiva with swelling and lymphoid hyperplasia.

7. This would explain their occurrence in trachoma and "inclusion-blenorrhea" without the assumption that they have any relation to a virus. The presence or absence of inclusion bodies would hence appear to be of no importance in the etiology or diagnosis of trachoma. The question whether "inclusion-blenorrhea" is a distinct clinical entity is not considered here, but work is in progress that may help to determine this.

CYSTIC DEGENERATION OF THE RETINA*

BERNARD SAMUELS, M.D.
NEW YORK

The cystic spaces commonly seen in the retina at the ora serrata have been discussed in the literature over a long period of years. This paper deals with cystic degeneration in the posterior portion of the retina. However much the cystic degenerations in the two locations may resemble one another anatomically, they occur independently. The presence of one has no influence on that of the other.

CLASSIFICATION

The microscopic specimens used in this study embrace practically every condition in the pathology of the eye. The cavities may be classified as follows:

I. *According to Location.*—The following classification is made according to the location of the cavities:

1. With reference to the optic nerve. The spaces are more pronounced on the temporal side, to which region they may be confined. They usually form a circumpapillary system.

2. With reference to the macular region. The largest spaces are invariably found immediately at the fovea. Other and smaller cavities encircle this point to form a macular system.

3. With reference to the layers of the retina. In point of frequency they are:

(*a*) The internal nuclear layer.
(*b*) The external plexiform layer (internuclear layer).
(*c*) The external nuclear layer.
(*d*) The nerve fiber layer.

II. *With Respect to Other Ocular Lesions.*—The cavities may be classified with respect to the following ocular lesions:

1. Detachment of the retina. The specimens show that cystic degeneration is more frequently encountered in detached retinas than in those in situ.

2. Glaucoma. In all forms of this disease the slides demonstrate how often cystic degeneration of the retina is to be expected at the nerve head and at the macula lutea, separately or together.

---

* Submitted for publication, June 9, 1930.

* Read before the American Ophthalmological Society, Hot Springs, Va., June 3, 1930.

3. Diseases of the blood vessels. It is striking how unfailingly spaces make their appearance after obstruction of the central vein and in albuminuric retinitis, as well as in the so-called diseases of Coats and Hippel.

4. Papilledema. It is chiefly in this condition that circumpapillary cystic cavities occur. However, cystic degeneration of the retina is by no means constant in choked disk. Often when the edema is marked the spaces are not found in the retina. The macular group of cavities is present at times in papilledema quite independent of the other group. In edema of the head of the nerve in hypotony one also encounters cavities in the adjoining retina. Cystic spaces in the retina and low detachment at the nerve head sometimes go hand in hand.

5. Iridocyclitis. One of the lessons taught by the survey is the frequency of cystic degeneration in the macular region following inflammations of long standing in the anterior half of the globe. This statement is particularly true of sympathetic iridocyclitis and syphilitic iritis. In the latter disease there are instances in which the circumpapillary system develops in the retina after optic neuritis. One interesting feature brought out is the great extent of damage that may occur anteriorly in tuberculosis before changes set in in the macular region. This probably accounts for the good light perception so long preserved in these cases. On the contrary, in serous iritis central light perception may fail from cystic degeneration when one might not suspect its presence from the observations visible anteriorly.

6. Endophthalmitis of mild degree. In this condition cystic degeneration is to be expected in the macular region. In many cases this accounts for the failing vision.

7. Tumors of the choroid. In practically every case in which the retina was adherent to a sarcoma there was cystic degeneration—in one case so marked that the retina was divided into two layers. This also holds true for metastatic carcinoma of the choroid.

CAUSES

Disturbance of the Circulation.—In papilledema the adjacent retina is permeated with transudate from the swollen nerve head. In the latter, only edema results from the retardation of the lymph flow, whereas in the nearby retina greater damage is done, as is evidenced by the formation of cavities. The macular region suffers at the same time because of the stasis in the vascular system that surrounds it. Here, again, the edema results in cystic changes.

In glaucoma there is a disturbance of the circulation so that cavities form at the nerve and at the fovea.

In obstruction of the central vein and in other diseases of the blood vessels not only is the circulation interfered with, but generally considerable reaction develops from the presence of a large amount of transudate and of blood. It therefore comes about that in these lesions one encounters the most pronounced cystic degeneration of all.

Toxins.—(*a*) From in front. In those forms of iridocyclitis referred to of different etiologies the fovea degenerates because of poisons that reach it from far away. Under these circumstances there is always some evidence of inflammatory reaction in the way of lymphocytic infiltration of the walls of the nearby blood vessels. In several cases the distinction had to be made between glaucoma and an accom-

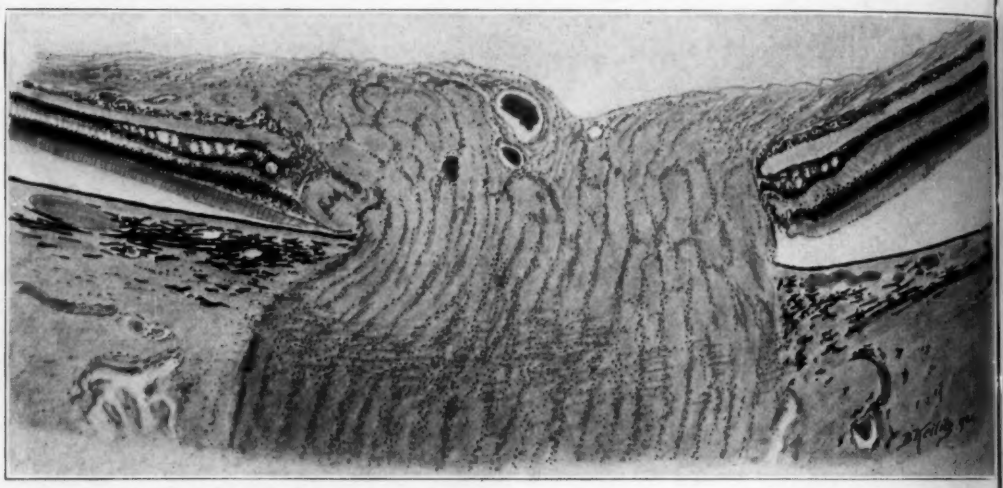


Fig. 1.—Typical circumpapillary cystic degeneration of the retina in the internal nuclear layer, in a case of beginning papilledema.

panying serpiginous ulcer. When there was no evidence of inflammation the diagnosis was circulatory disturbance, the result of glaucoma.

(*b*) From behind. The cases of tumors of the choroid to which the retina remained attached are clearcut examples of this form. In retinas that are detached the cystic spaces may be explained in two ways. The subretinal fluid is toxic, thus affecting the tissues from behind. The circulation is sluggish, thus reducing the vitality of the parts. Furthermore, obstruction of vessels is prone to occur.

Explanation for the Frequency of Cavities in the Internal Nuclear Layer.—The peculiar arrangement of the blood vessels on its anterior and posterior surfaces is certainly a factor if not the chief cause. It is here that transudation would first set in. It may be also that the cellular elements are more delicate in this layer (as suggested by

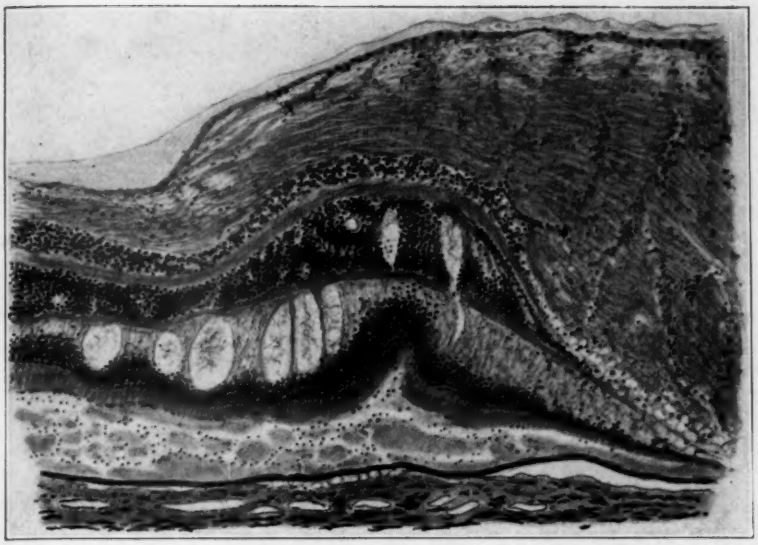


Fig. 2.—A low detachment of the retina sometimes accompanies cystic formation in the retina at the nerve head.

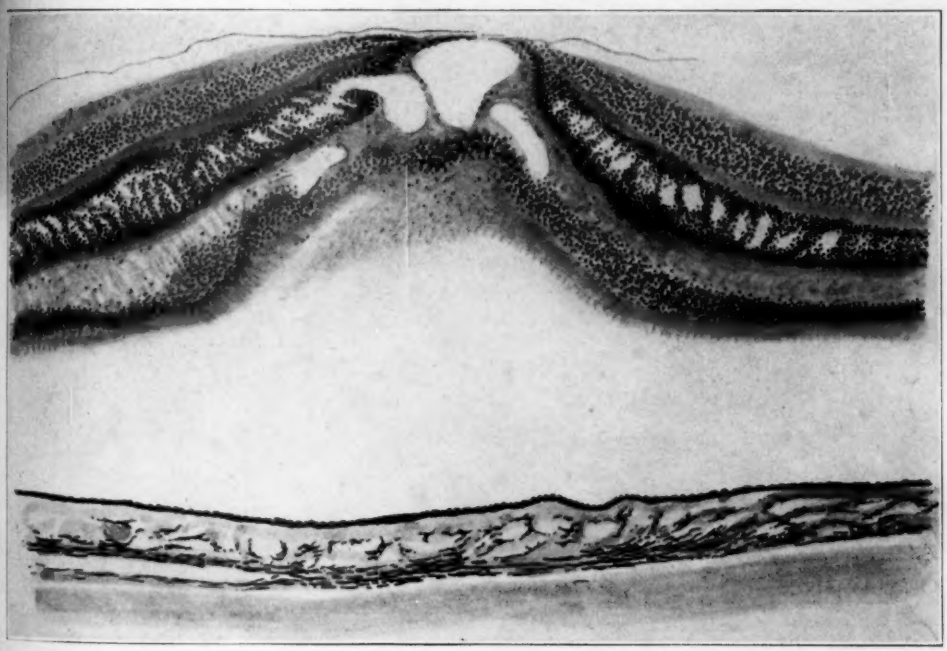


Fig. 3.—Cystic spaces in the internal nuclear layer at the macula lutea, caused by toxins in an old case of iritis.

E. Fuchs) so that they break down easily under the influence of edema. Still another hypothesis concerns the frail fibers that come off from the cells. Under the action of edema these may break, causing a secondary atrophy of the granules.

That the external plexiform layer ranks next to the internal nuclear layer in point of frequency of involvement may be explained by the assumption that the transudate passes indirectly into it from the capillaries of the internal nuclear layer. The external nuclear layer suffers

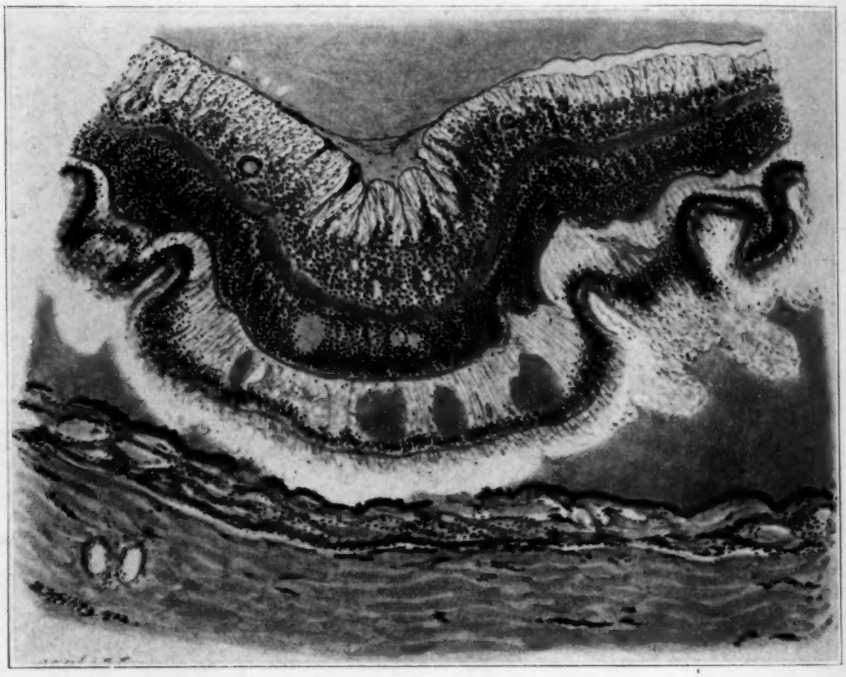


Fig. 4.—Cystic spaces which have developed rapidly at the macula lutea as a result of inflammation after severe injury.

most when the toxins come from behind as in cases of tumors or inflammations of the choroid or detachment of the retina. In glaucoma not only the nuclear but also the nerve fiber layer is affected.

Explanation for Frequency of Involvement of the Macular Region.—This region is the most delicate and highly organized spot of the retina. It contains no blood vessels so that the circulation is sluggish. A transudate can be carried off only with difficulty. It is vulnerable not only in cases of toxins but also in circulatory disturbances.

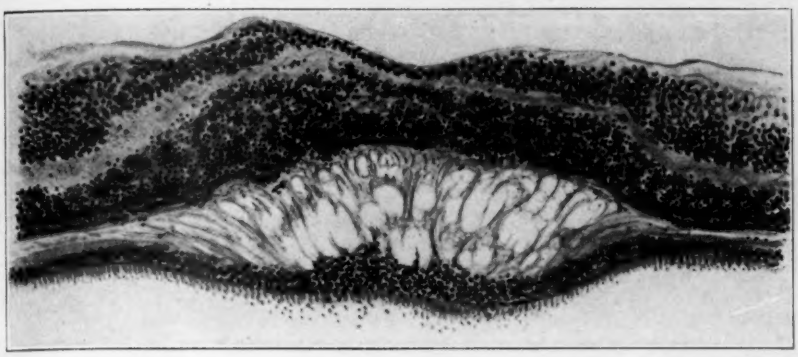


Fig. 5.—Cystic degeneration at the macula lutea in retinitis syphilitica.

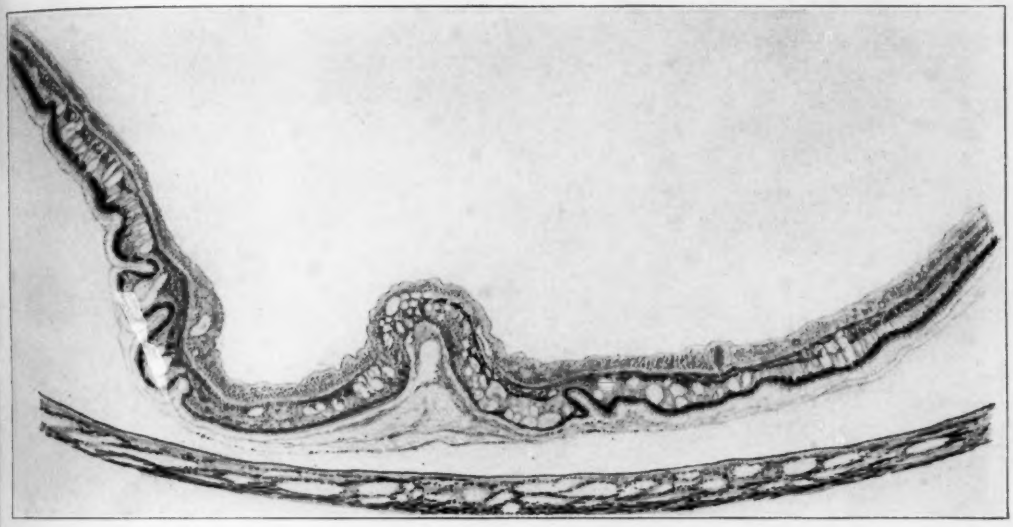


Fig. 6.—In this case of albuminuric retinitis the cavities are the result of inflammatory changes.

Fig. 7.—In retinitis exudativa (Coats' disease), according to the specimens, cavity formation is an almost constant occurrence.

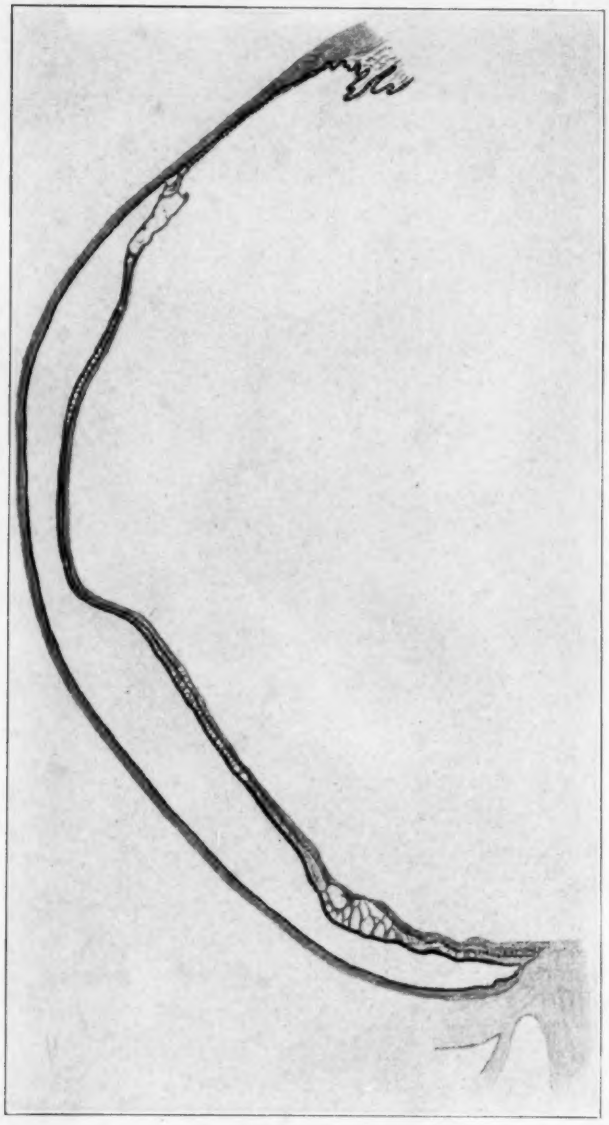


Fig. 8.—Three fields of cysts, which are not connected, in a case of glaucoma after thrombosis of the central vein.

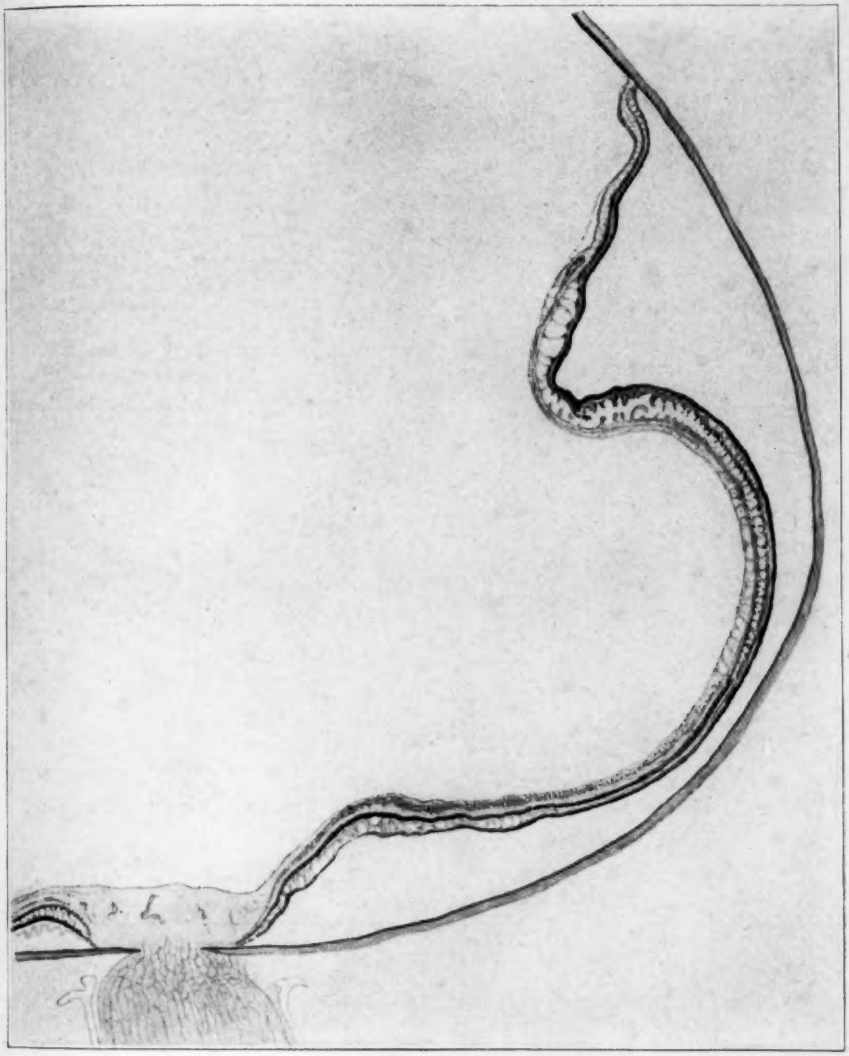


Fig. 9.—A rare instance of peripheral and circumpapillary systems of cysts approaching each other to within a short distance. The clinical diagnosis was Hippel's disease.

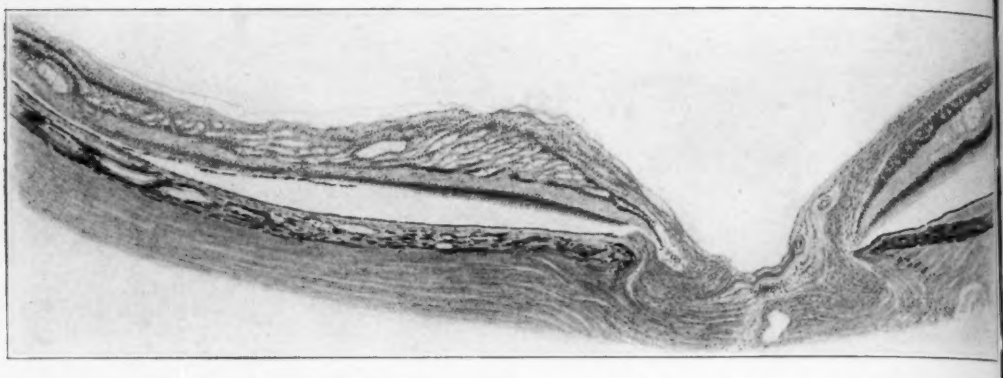


Fig. 10.—Secondary glaucoma following iritis, with occlusion of the pupil. Note that the cavity formation is confined to the inner layers of the retina—those supplied by the retinal artery. There is no inflammatory reaction, so that the cause of the cysts may be ascribed to stasis.

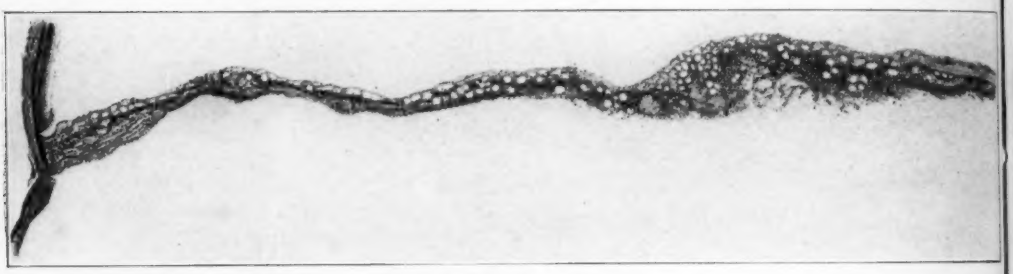


Fig. 11.—These small round holes have the appearance of cysts. They are filled with fat, representing another form of degeneration.

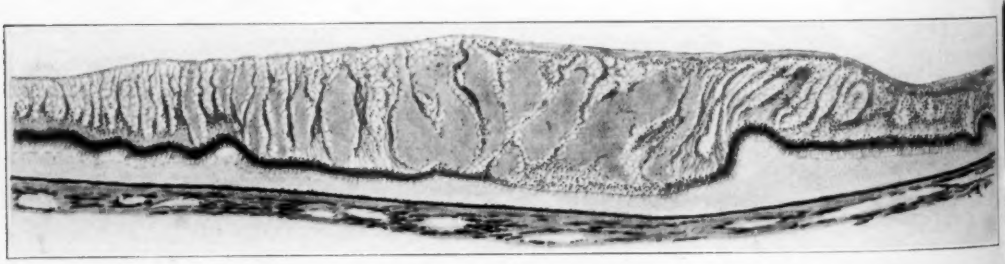


Fig. 12.—The eye was lost on account of the secondary glaucoma that developed after a perforating corneal ulcer. In the distended cystic area the supporting fibers have suffered almost as much as the cellular elements.

In injuries, such as contusions and perforating wounds, the fovea suffers the most. Hole formation in the fovea is always preceded by cystic degeneration. According to Verhoeff, holes elsewhere in the retina are the result of the same process.

METHOD OF FORMATION OF CAVITIES

Without Distention.—The small irregular spaces so many times seen, especially in the internal nuclear layer, appear to be the result of a simple death of the cells. There are no other changes.

With Distention.—The edema may press the cells apart without causing their disappearance. Usually the cells undergo pressure atrophy. In the first stage spaces due to distention are round. Later

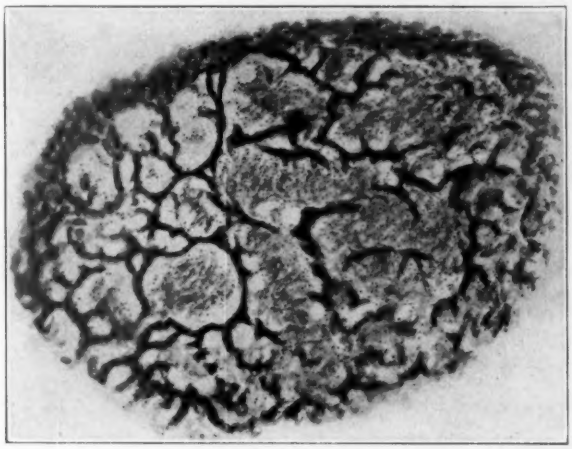


Fig. 13.—Cysts cut on the flat to show the "honeycomb" effect seen with the ophthalmoscope.

they elongate perpendicularly to the surface. The compressed supporting fibers form the walls. As is well known, cavities in one layer often become confluent. They frequently break through into other layers.

At times circulatory disturbance causes the production of cystic spaces in all of the layers of the retina—a kind of universal cystic degeneration. This picture may be seen in glaucoma.

That a special type of cavity develops at the fovea is explained by the histology of the part. Here there are no supporting fibers of Mueller to confine the transudate so that large globular formations result.

A similar type of cavity is that in which from severe toxins, as in abscess of the vitreous or from cutting off of the circulation, not only

the cellular elements but also the supporting fibers are affected. Large irregular cavities with an ill defined wall result.

CONTENTS OF THE CYSTS

The older cysts and those that have formed slowly are filled with a clear fluid that takes little stain. Recent cavities particularly those that have come after severe inflammation, are apt to be filled with a highly albuminous fluid. At times the albuminous character is exceedingly marked. Old spaces and recent spaces, that is, clear spaces and highly albuminous spaces, on occasions are seen side by side. From the nature of the contents one may judge the cause and the age. A number of times the cavities are filled with red blood cells due to intercurrent hemorrhages, as in obstruction of the central vein. This filling of pre-existing spaces with blood has been noted clinically.

Pseudocysts.—In several of the preparations, round spaces were seen disposed without regard to the layers of the retina. Under high magnification it was seen that they have a delicate granular reticulum. They appeared to be not areas of cystic degeneration, but spaces that had been occupied by fat.

INFLUENCE OF CYSTIC DEGENERATION ON THE THICKNESS OF THE RETINA

The thickness of the retina is not increased when the spaces are the consequence of mere atrophy. Some large flat spaces were found without any increase in the thickness of the retina; neither was there any unevenness of the internal surface. When the cysts are large and due to distention, the retina may be bulged out to many times its normal thickness. If it remains attached to the choroid, the internal surface becomes undulating. No instances were encountered to suggest that the cysts ever collapse to cause a thinning of the retina.

Finally, the specimens show that cystic degeneration is associated with severe pathologic changes. They demonstrate how differently the optic nerve and the retina react to the same agent. For instance, a disturbance of the circulation may cause edema of the nerve, the fibers and columns of the nuclei being separated but no actual spaces forming. Immediately adjacent, from the same cause, the more delicate retina may be torn up into free spaces—cystic degeneration.

COMMENT

As far as is known, this is the first attempt that has been made to study systematically cystic degeneration of the retina at points distant from the ora serrata.

THE MOSHER-TOTI DACRYOCYSTORHINOSTOMY*

EDMUND B. SPAETH, M.D.
PHILADELPHIA

It has been necessary recently on several occasions to defend experiences and ideas relative to the Mosher-Toti combined intranasal and extranasal dacryocystorhinostomy. My experiences with this operation have been so satisfactory that some doubt exists as to whether this valuable procedure is receiving its due.

I have performed thirty-three operations of this type and have assisted at several more cases extending over a period of about six years. Following one of these, a conversation with an internationally known ophthalmologist resulted in the decision to try to clear up some of the doubt and conjecture connected with the operation. The indications and reasons for recommending it, together with its rationality, should first be considered.

Several years ago, while working at the Palo Seco Leper Colony in the Panama Canal Zone on the rôle of the lacrimal sac in the causation of the ocular complications of leprosy, opportunity arose to observe the functioning of the canaliculi and of the tear sacs. This consisted in timing the rapidity of the appearance of a 15 per cent aqueous solution of mild silver protein in the inferior meatus of the nose under varying conditions: (*a*) with the normal anatomy intact, (*b*) after slitting of the canaliculi, (*c*) after a stab puncture of the sac with a stylet or an artificial fistula in the sac and (*d*) with the use of positive and negative air pressure in the sac through the stylet. As a result of these observations, the conclusion was reached that a possible aspiratory function of the sac is decidedly of minor importance in regulating the normal drainage of the tears from the culdesacs, compared with a much more important capillary tube action of the canaliculi.

In cases with normal anatomy, the mild silver protein appeared in the nose without fail, and occasionally in as brief a time as one minute. With the lower canaliculus slit (unfortunately for the value of these observations, the upper canaliculus was intact), the mild silver protein did not appear within less than ten minutes in any instance, and usually it failed to appear. An epiphora was present in most instances. Mercurochrome-220 soluble, a much lighter weight solution, did not appear in the nose, even after the forcible irrigation of the inferior meatus with physiologic solution of sodium chloride. This procedure occasion-

* Submitted for publication, June 14, 1930.

* From the Peter Clinic, Graduate School of Medicine, University of Pennsylvania.

ally forced out the mild silver protein. The procedure was repeated with an artificial or augmented lacrimation induced by the instillation of 1 per cent solution of ethylmorphine hydrochloride into the conjunctival culdesac. With the canaliculi intact, it hastened the flow of the tears and the appearance of the mild silver protein. In the cases with a slit canaliculus it simply increased a mild silver protein-stained epiphora.

In the cases with a stab puncture into the sac through the skin, two types of stylets were used. One was a dumb-bell-shaped perforated stylet with bulging ends wide enough to hold it in contact with the anterior wall of the sac, well away from the internal punctum, and to prevent it from slipping out of the skin-sac wound, a rather satisfactory fistula. The other stylet was an ordinary grooved lacrimal cannula with its upper end bent into a smooth curve. This was passed into the sac through the stab puncture and thence into the lacrimal-nasal duct.

The same solution of mild silver protein was used, with and without the lacrimation induced by the ethylmorphine hydrochloride. There was no difference in the behavior of the tears in the cases of fistula with intact canaliculi, only now the major portion of the mild silver protein-stained tears was discharged through the orifice of the stylet, though the nasal secretions also showed the stain. This, however, was delayed. It appeared on the surface of the skin later than the mild silver protein. The sac was thus discharging through two openings, at first through the fistula and later through the nasal duct. Certainly, any pump action of the sac was impaired if not nullified.

When the other type stylet was used, the drainage of the tears was completely stopped. After a short time an intractable epiphora developed. All that this stylet did was to occlude the lacrimal-nasal duct, as well as to prevent drainage through the perforation in the skin. Later, there was some leakage about the stylet.

Negative and positive pressure was applied through a narrow catheter attached to the first of the stylets mentioned. The negative pressure was obtained by the use of a large 20 cc. glass Luer syringe. The slow withdrawal of the plunger could be maintained for almost ten minutes before the plunger would be at the extreme of its working position. Positive pressure was obtained by a gas-oxygen rebreathing bag. Ethylmorphine hydrochloride was also used to stimulate lacrimation. When negative pressure was used no mild silver protein passed into the nose; neither did it appear to hasten the drainage of the conjunctival culdesac. This was repeated many times with the same results. When positive pressure was used, the mild silver protein appeared in the nose, though it was somewhat delayed. The point of importance is this: The canaliculi continued to drain in spite of changes of pressure in the sac.

These few observations prove nothing; they are incomplete and incidental to a wholly different problem, but with them it does seem as if the canaliculi and their integrity are far more important in the conduction of the tears from the culdesacs than is the sac itself and any function that has been ascribed to it. The motion of the canthal ligament over the sac, caused by winking of the lids, can well impart a suction and injection action to the sac as it lies in its posteriorly rigid bed. This is seen during winking when one weeps. If this winking is due to the lacrimation, it may be the natural attempt to deal with the excess of tears. Excluding these emotional excesses, it is not certain that winking is absolutely essential to the passage of the tears through the canaliculi into the sac and from there through the lacrimal-nasal duct. There is no constant and true valvelike structure in the nasal duct. This would seem essential, in structure similar, as well as in action, to the common "butter-fly" valve. Therefore, while this aspiratory function cannot be denied, the statement is at least open to logical argument.

INDICATIONS FOR OPERATION

Naturally, all cases of dacryocystitis are not proper cases for the rhinostomy operation. In speaking of the operation, Knutson said, "certain cases give a bad surgical result, they are those in which the function of the canaliculi can be expected to be checked or to have ceased," and, further, "in order to quickly and relatively painlessly relieve the patient of the acute inflammation in the immediate surroundings of the lacrimal sac, and from fistulae, external extirpation becomes the rational procedure." But with further and proper ameliorative treatment this can be postponed so that later in the course of the disease a rhinostomy operation may be done with a promise of good results. Intra-ocular operations, when postponed because of dacryocystitis, should be preceded by an extirpation rather than by rhinostomy, unless it is possible to allow several months to intervene between the two operations. The reasons for this are clear. In tuberculosis of the sac a cystectomy is indicated; this applies to neoplastic growths as well. One of the failures in the Peter clinic was in a case of undiagnosed tuberculosis of the sac.

Fistulas are not a contraindication, no matter how long they may have existed. Attention to them may be necessary after the operation, but closure will be prompt. In the two instances in which these were present closure was assisted, perhaps, by chemical cauterization of the tract with trichloracetic acid. One was an earlier incision of an empyema of the sac, the second was a spontaneous rupture of an acute dacryocystitis with extensive suppuration. Both appeared with a late

chronic obstructive dacryocystitis. During the acute stages of dacryocystitis, rhinostomy is contraindicated. Drainage of the sac should be attempted by the present standard methods and if unsuccessful by incision of the sac. If the canaliculi can be left intact, the complication of a fistula is nothing compared to a later compulsory cystectomy.

We have not operated on a patient younger than 6 years, but the age of the patient is no serious factor once an obstructive process has developed and has remained intractable to other forms of treatment. Operation in the presence of a chronic suppurative process is simplified by reason of the large dilated sac and the greater ease with which it is identified. Disease of the surrounding bone is not a contraindication to the operation if the osteomyelitis is not of such a severe degree as to demand extensive curettage and sequestrectomy. Under such circumstances, the cicatrix would without doubt close and otherwise distort the bony fenestrum. Naturally, tuberculous osteomyelitis is a contraindication.

RATIONALITY

In this paper I shall consider only Mosher's modification of Toti's original operation. The simple technic, compared with that of two other rhinostomies, is sufficient for our exclusive use of it. The original Toti operation will be described later. With any dacryocystorhinostomy, the end-results, to be successful, must include the absence of epiphora as well as the cessation of any inflammation or suppuration in the sac and its adnexa. A cystectomy achieves the latter but not the former. As the technic of this, as well as of the original, operation is read, it is rather interesting to note that it is almost a reversal, at least in a large part, of a procedure recommended by Cirincione, in 1913, in *La Clinica Oculistica*. De Schweinitz has also called attention to a procedure, most similar, described in a letter by Heinrich Heine, about 1845, to a friend who was afflicted with a dacryocystitis. Fuchs, in speaking of the original Toti operation stated, "epiphora was cured in about 50 per cent of the cases."

Beard stated that "since the sole aim and end of the operation is relief from the troublesome epiphora, unless the function of the lacrimal canals from the conjunctiva to and into the sac are undisturbed, the measure will avail nothing."

After a Mosher-Toti operation, the sac no longer exists per se. Its anterior external wall with the internal common punctum then form part of the nasal mucosa. The punctum discharges directly into the middle meatus of the nose, anterior to and slightly below the tip of the middle turbinate. In this position the common punctum is subject to the diseased conditions common to the nasal mucosa, and by its prox-

imity to those of the middle turbinate and the ethmoids, especially to closure from pressure. These possibilities must be remembered, but they do not decimate against the operation. A bony opening, such as is made in this operation, should be closed by bone growth in that it is disharmonious to nature—to the usual tissue reactions toward maintaining the strict pattern of the human skeleton. On the other hand, with the soft tissues lying in this fenestrum, it is possible that nature's cries become soothed, and this window is thus allowed to remain unclosed. Soft tissues interposed accidentally between fragments of bone, as with comminuted fractures, or intentionally, as in an arthroplasty, remain and the growth of bone ceases. This possibility is not improbable. A more positive statement relative to it cannot be made. Late results, as observed in responsible patients, must be the real criteria of the operation.

Six cases were recently reviewed. They were selected at random, the patients having been operated on at intervals of one, three, five and six years previously. All of them, based on information received through the questionnaire, remained cured of their earlier complaints. Three of these patients had chronic suppurative dacryocystitis, with large dilated sacs. The other three had similar cases, but with small, contracted, obstructive sacs, without active suppuration. While the records of the other cases are not all as complete, as far as can be ascertained largely from conditions present at the time the patients were discharged, only four of the total number of cases were failures.

Of these four patients, one is improved to the degree that further operative treatment is unnecessary. A second has not been seen since her operation, but the report received from her physician is that she is still suffering from epiphora. In one of the other two cases of failure, the patient has since undergone an operation for extirpation of the sac. The percentage of successes is thus about 87 per cent. True, it is a small series, but fortunately, an operative dacryocystitis is not the most common of the many ophthalmologic conditions. Further, the second state of a person who has undergone an unsuccessful dacryocystorhinostomy is not wholly unlike that of one who has had a successful cystectomy.

One may compare this percentage of recoveries with Gilbert's observations in an analysis of a series of forty-five cystectomies. In this group, not one patient was free from epiphora one and one-half years after the operation, and in about 50 per cent of the cases this condition had persisted for from two to five years. In many cases the epiphora was severe and was made worse by wind and cold. In most instances, the patients denied relief from the lacrimation and were willing to

undergo further surgical intervention if relief could be offered. It is no wonder that Mosher said, "ophthalmologists, to the contrary, epiphora does persist after cystectomy."

The nose should be examined a few days prior to the operation, and in cases with an enlarged middle turbinate, the tip of the turbinate must be resected then and not at the time of the rhinostomy. Ethmoidal disease and nasal polypi must first be corrected. Atrophic rhinitis, if at all extensive, is a contraindication. Hypertrophic nasal disease needs preliminary treatment. Bilateral dacryocystitis should be corrected at different times. A severe deflection of the septum could be a bar to the operation, but this has not occurred within my experience.

The scar that results from the operation is not conspicuous. The period of hospitalization should be from four to six days. After this time the intradermic suture may be removed, and the patient may be discharged from the hospital. Additional observation and treatment will last from ten to thirty days. Occasionally, it is necessary to syringe the nasal cavity through the canaliculus to remove obstructing clots and scabs. In two instances the operation was done with the patient in the office chair, but this is not recommended, save for imperative reasons.

TECHNIC

The patient should be in a semireclining position, as comfortable as possible and under morphine-scopolamine analgesia. Local anesthesia, in addition, is sufficient except for children and nervous adults. The nasal mucosa is anesthetized by wiping and then packing with a 10 per cent solution of cocaine. Both cotton and gauze tape is moistened in this solution and then wrung dry to prevent, as much as is possible, systemic absorption. After anesthesia is complete the posterior nares and inferior meatus should be packed with narrow plain tape to prevent the posterior nasal space from filling with blood and mucus. This may cause nausea and gagging, and there is also danger of inhalation of the fluids. In addition, hemorrhage is controlled and the operator knows whether the amount of bleeding present is of a dangerous degree. The last point can be of great importance.

The conjunctivae are cocainized with a 4 per cent solution, and the infra-orbital and supra-orbital nerves are blocked at their points of egress according to Labat's technic with 2 per cent solution of procaine hydrochloride. An intradermic wheal over the sac is also necessary. Some patients may object to the sound and impact of the mallet on the chisel, but only from psychologic reasons and not because of pain; they are no more easily quieted because of this than if the discomfort originated from pain. It is not a great problem, however.

The instruments necessary are: a small scalpel, tissue forceps, two small mosquito hemostatic forceps, lacrimal sac speculum, as illustrated, sharp and blunt periosteal elevators (submucous type), straight, sharp and blunt scissors, small straight edge chisel, small mallet, Kerrison punch, conchotome, bayonet nasal forceps, nasal speculum (self-retaining type), nasal applicators, lacrimal probes, needles and needle holder, 000 dermol and 00 plain catgut.

Mosher controlled the hemorrhage from the edges of the skin, as well as deeper, with Michel skin clips. We have found these unnecessary. Major A. E.

Schlanser, U.S.A., first devised a bent, small caliber, glass tip for aspiration of the hemorrhage, in this way keeping the field of operation easily seen.

The incision lies 6 mm. from the inner canthus, starts on a level with the crease of the upper lid and runs downward in a nearly straight line, on the ascending process of the superior maxilla, parallel to the bed of the sac, and stops 3 mm. below the level of the bony orbit. The incision, with the first cut, is made into the periosteum. The sac is found, exposed and turned from its bed by entering the orbit above the sac and elevating the periosteum of the orbit from above downward by blunt dissection. The periosteum of the inner wall of the orbit is elevated for 2 or 3 mm. beyond the crest of the lacrimal bone. The sac is freed and turned outwardly until the beginning of the lacrimal duct is clearly seen. The lacrimal bone in front of the crest is then broken down with a small chisel and mallet. A sufficient opening is made to allow the introduction of a Kerrison punch. With this the remainder of the lacrimal bone in front of the crest is bitten away. The same procedure is carried out on the posterior edge of the ascending process where this makes the anterior half of the bed in which the sac rests. The opening in the bone should be at least equal to the width and height of the sac. Then with a small conchotome the inner wall of the nasal duct is bitten away to the level of the tip of the middle turbinate. The inner half of the sac and the inner half of the soft tissues of the nasal duct are then resected with forceps and scissors and with a conchotome in the last instance. It is essential to leave the outer wall of the sac for in this the common punctum is placed. In distended sacs this is seldom endangered, but in small sacs care must be taken not to injure the common punctum. The mucous membrane of the nasal cavity is removed when it presents in the bony window, and is trimmed flush with the edges of the window. The region of the nose opposite this opening is made free from tags of the middle turbinate and from the anterior ethmoidal cells. This is done in order that the granulations that occur during healing will not encroach on the bony opening and seal it. After the soft tissues are replaced, the skin is closed with an intradermic suture. The foregoing technic is an almost verbatim copy of Mosher's original presentation. Certain personal explanations follow.

Porter modified this technic by suturing the periosteum of the ascending process of the maxilla to the anterior lip of the sac. We do this as well. In addition, the incision is made between 6 and 8 mm. from the canthal angle, higher on the bridge of the nose. The hemorrhage is less at the start, and subsequent healing allows a straight nondepressed scar. As soon as the incision into the skin is made—down to the periosteum with the first cut—there is active bleeding. While Mosher has recommended skin clips for this, if the lacrimal sac retractor is introduced immediately under fair tension, the bleeding will be checked greatly by the stretching of the edges of the wound. Gauze sponging can be dispensed with throughout the operation if the suction sponging mentioned is used. As soon as the periosteal edges are seen, they should be lifted with a sharp periosteal elevator, the submucous type being convenient. A blunt elevator is then used further to elevate the periosteum away from the edges into the orbit and for any further necessary dissection. Blunt dissection with a piece of gauze tightly wrapped over the tips of stout tissue forceps will assist decidedly in the eversion of the sac and the elevation of the periosteum without damage to it, and will minimize hemorrhage. The excision of the walls of the sac may be delayed until the bony window has been completed. The size and exact position should be tested several times by fitting the sac into the opening until one is satisfied as to its correctness. It is wise to prevent, if possible, the perforation of the nasal mucosa until the

window is completed. When finished, a blunt elevator can be passed into the nostril, lateral to the packing, and the nasal mucosa put on a stretch into the bony window with it. While in this position, it can be easily grasped with a forceps and readily resected. After that its edges may be further trimmed with the punch. After the walls of the sac have been resected, the soft tissues

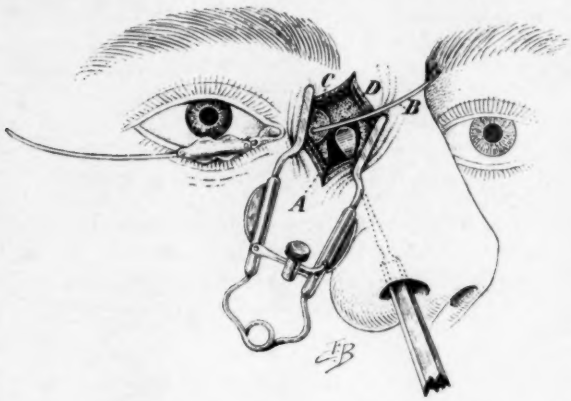


Fig. 1.—Operative field of the rhinostomy. *A*, bony window; *B*, probe in the inferior canaliculus emerging from the common punctum; *C*, remains of the walls of the sac after resection; *D*, bone of the orbit and contiguous regions.

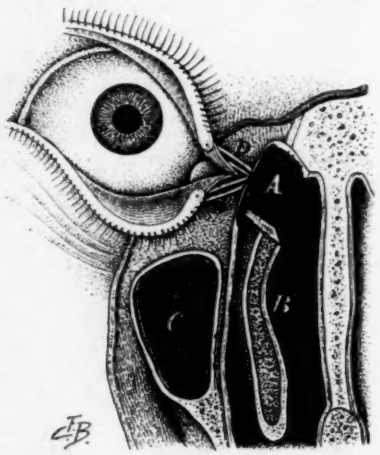


Fig. 2.—Diagrammatic drawing to show the tissues resected. *A* shows the position of the window with the posterior wall of the sac removed; *B*, the level of the attachment of the inferior turbinate; *C*, the maxillary antrum. The duct which lies between the inferior turbinate and the lateral nasal wall is the lacrimal-nasal duct now not functioning. *D* and *D'* are the canaliculi joined at the common internal punctum.

of the duct are also trimmed with the punch. A probe is then passed through the inferior punctum and canaliculus and through the common internal punctum. One can then inspect carefully to determine the accuracy of the partial resections of the wall of the sac and to be certain that the common punctum has not been injured. The operator can also see that the remaining wall of the sac, when turned in by the rotation of the probe, fits accurately into the bony window.

The anterior lip of the periosteum is then sutured to the anterior lip of the wall of the sac by two interrupted 00 plain catgut sutures. After this, the fascia over the sac, a thin subdermal layer consisting of the fine medial fibers of the orbicularis oculi and the internal tarsal ligament, is closed by one catgut suture to the subdermal fascia displaced forward by the stretching of the speculum. This renders the scar less conspicuous and prevents an unwanted dead space. The edges of the skin will now approximate of themselves and can be united with

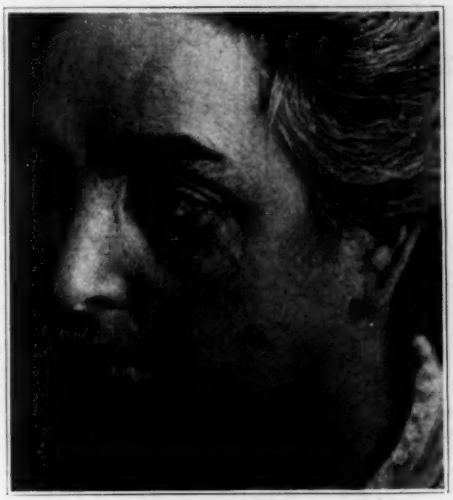


Fig. 3.—Scar of a dacryocystorhinostomy three months after the operation.

a dermal intradermic suture. The ends should be left untied and without tension. This will allow a smooth scar later. A light pressure bandage is applied for three days. The nasal packing is then removed and fresh strips are introduced, one closing the posterior nares, a second up along the lateral wall of the nose to guard against late intranasal hemorrhage and to hold the edges of the nasal mucosa window in accurate apposition with the edges of the nasal bony window. The former strip may be removed within twenty-four hours, and the latter after forty-eight hours.

The original Toti operation differed in that the incision was a semicircular crescent, parallel to the internal commissure of the lids, i. e., parallel to the orbital rim. While it was planned to conserve the anterior wall of the sac as the most important point, thus having it form a part of the nasal mucosa, the bony opening was too small, and no attempt was made to suture the wall of the sac into the bony window. Part of the disrepute into which the original Toti operation fell was also, without doubt, due to the poor selection of cases in which it was used. I have seen this personally.

Figure 1 shows the field of operation at the completion of the dissection. The wall of the sac is rotated outwardly to present the internal common punctum to view. Figure 2 is a drawing to illustrate the amount of bone and soft tissues removed. The bone resected includes the lacrimal fossa and the upper portion of the lacrimal-nasal duct, the external lip of the nasal process of the superior maxilla where it is in articulation with the lacrimal and occasionally a portion of the ethmoid and the tip of the middle turbinate bone. Figure 3 shows a scar three months after operation.

CONCLUSIONS

The operative technic is not difficult, even for the operator who has never performed intranasal operations. It has several points to offer over the pure intranasal rhinostomy. The percentage of cases in which the epiphora is cured is much greater than with the cystectomy; as long as this is one of the outstanding symptoms for which the patient seeks relief, it must be considered seriously. In certain individual cases it does not replace cystectomy; hence selection of cases is necessary for satisfactory results. The period of recovery is short. The scar is no more conspicuous than is that from cystectomy. There should be no danger of inferior oblique impairment as a result of the surgical procedure. Fistulas will not develop, and when present will clear up promptly. The procedure lends itself to certain complicated cases. Lastly, it seems as if time and the end-results have substantiated the claim made by Mosher in 1921, that this method of attack in properly selected cases is a good surgical procedure giving satisfactory results. I endorse this procedure heartily.

TUMORS OF THE OPTIC NERVE *

ROY R. GRINKER, M.D.
CHICAGO

Out of the chaos of all the so-called gliomas of the brain, Bailey and Cushing [1] were able to make an orderly, workable classification by studying the predominating cell types of the various tumors and correlating them with a particular stage of histogenesis of adult nervous tissue. They were able to accomplish this feat by utilizing specific methods of impregnation with silver salts devised mainly by Cajal and Hortega. Such attempts, except in one instance, have as yet not been applied by ophthalmologists, yet the proper fixation of retinal and optic nerve tumors and the use of modern staining methods instead of celloidin hematoxylin-eosin preparations are essential to the advancement of knowledge concerning them.

However, although one must await further work to complete the knowledge of the probable glial tumors, the careful cellular studies already made enable one to classify the tumors described in the literature. Tumors of the optic nerve, as yet reported, are probably all of the spongioblastic unipolar or bipolar type. But since the optic nerve arises from an evagination of the primitive cerebral vesicle and contains all the adult forms of neuroglia, any or all of the gliomatous tumors described in the brain should be found arising from the optic nerve.

For the purpose of reviewing the diagnostic procedures, neurosurgical approach and clinical course of intracranial gliomas of the optic nerve the following description of a fairly typical case is appended.

REPORT OF CASE

Clinical History.—E. M., a girl, aged 13, entered Billings Hospital on Dec. 31, 1928. Two years before she had been knocked into unconsciousness for two hours by a blow on the head received in an automobile accident. Two days later, severe frontal headaches, nausea and vomiting developed and continued in attacks until two months before admission, when these symptoms became much more severe. Gradually failing vision had been noted during the two years, but for two months it had been pronounced.

Examination.—The patient was well developed, with prominent breasts and pubic hair (menstruation had begun at 12 years). The olfactory sense was normal, as was the function of all the other cranial nerves except the optic. There

* Submitted for publication, July 11, 1930.

* From the Division of Neurology, Department of Medicine of the University of Chicago.

1. Bailey, P., and Cushing, H.: A Classification of the Tumors of the Glioma Group, Philadelphia, J. B. Lippincott Company, 1926.

was no change in motor or sensory functions. All the deep reflexes were active and equal; there were bilateral Babinski reflexes and unsustained ankle clonus. Chemical analysis of the blood and Wassermann and Kahn tests gave negative results. There was no polyuria.

The external ocular movements were normal and the pupils dilated. The left pupil reacted slightly to light; the right not at all. The peripheral retinas were normal. The right disk head was slightly pale in its lower temporal and nasal quadrants, while the upper quadrants revealed a choking of 4 diopters. The entire temporal half of the left disk was pale, but the nasal half was swollen 3 diopters. There was a right homonymous hemianopia, of an absolute and complete type, with a margin through the fixation point. The left lower quadrants of the visual fields were normal, while the upper left quadrants showed a marked contraction for red. The vision in the right eye was $0.6 + 2$; in the left, $0.4 - 1$.

These observations indicated the diagnosis of a glioma of the optic chiasm. Roentgenograms showed a diastasis of the cranial sutures and an increase in the size of the sella turcica; its floor was depressed into the sphenoid sinus and undermined the anterior clinoid processes. There were small dots of midline suprasellar calcification which raised a doubt as to the diagnosis, suggesting instead a suprasellar cyst. Ventriculography tended to confirm the latter opinion, as the lateral ventricles were dilated and the third and fourth ventricles were not visualized. Roentgenograms of the optic foramina showed clearly a marked dilatation of the left optic canal (fig. 1).

Progress.—On Jan. 11, 1929, a transfrontal craniotomy was performed by Dr. Percival Bailey. The right frontal lobe was retracted after the ventricle had been punctured. The right optic nerve was then found flattened and stretched over the surface of a bulging, dark brown tumor mass which filled the midline as far as could be seen. Further posteriorly the optic nerves spread into the mass, which was not cystic. The skull was closed without disturbing the tumor.

On February 1, the patient was entirely blind. The left disk was atrophic without swelling, whereas the right disk showed an increasing whiteness and a decreasing swelling. An uneventful recovery from the operation took place, and deep roentgen therapy was directed to the chiasm.

On November 22, the child returned to the hospital for more roentgen therapy. During the intervening months, vision had improved sufficiently to enable the child to do coarse sewing. However, lately vision had been decreasing again and light perception only could be obtained through the right eye, whereas the left eye was totally blind. Vision in the right eye was 0.2 and extended only 5 degrees around the fixation point in all meridians. The disks showed a right secondary atrophy and a left primary atrophy.

On April 5, 1930, the patient was brought to the hospital struggling and maniacal, with a normal pulse rate and blood pressure. Roentgen therapy was begun, but the patient became unconscious, assumed an opisthotonic posture and appeared in a decerebrate attitude. The pulse was only 64 per minute, and the respirations were of the Cheyne-Stokes type. A lateral ventricle was punctured and 40 cc. of spinal fluid shot out under great pressure. Another such attack occurred three days later, so that a subtemporal decompression was performed on the right side. Recovery was uneventful without return of attacks.

On June 10, the patient returned for more roentgen therapy, with complete atrophy of both disks and vision of only $0.1 + 1$ in the right eye. However, no other neurologic observations could be elicited. The patient's general condition is good at the time of writing, eighteen months after the first operation.

Fig. 1.—The upper figure shows the normal right optic foramen; the lower figure, the dilated left optic foramen.

COMMENT

The finding of a homonymous hemianopia with its margin through the fixation point, marked disturbance in the pupillary reaction and the combination of partial optic atrophy and partial mild papilledema fixed the location of the tumor about the chiasm. The suprasellar calcification deviated my attention to the possibility of a tumor of Rathke's pouch. Since this type of tumor could be attacked surgically and the chiasmal glioma could not, it was felt that an exploration was the only fair procedure for the patient even though the dilated optic foramen seemed to be conclusive evidence of a glioma of the optic nerve.

When the chiasm was exposed and the tumor found within it, no attempt was made to disturb it. This conservatism has been induced by the fact that simply handling the chiasmal gliomas often results in death with hyperpyrexia, probably because of a disturbance of the heat regulatory center at the base of the brain back of the chiasm.

Deep roentgen treatment was given to the patient with control of the growth of the tumor, as evidenced by the life span of now eighteen months after she was first seen. This agrees with the conception that the spongioblastic cells comprising these tumors are histogenically very primitive, since the malignant early cell types are most amenable to roentgen therapy.

Extension of the tumors arising from the intracranial portion of the optic nerve is usually backward along the base of the brain. This may produce certain vegetative symptoms by involvement of the diencephalic centers, such as disturbance in fluid or fat metabolism or disturbances in heat regulation. Far more severe is the obstruction of the spinal fluid flow through the narrow third ventricle spasmodically or constantly. Ventriculography demonstrated such a process in the ventricular dilatation and difficulty in filling of the third and fourth ventricles. The sella turcica was also eroded by the tumor.

The attacks of decerebrate posture with slow pulse and stupor were examples of periods of more marked compression of the third ventricle, so that a decompression was done to act as a safety valve during those periods of more complete ventricular obstruction. Eventually, this will not suffice, as when the third ventricle becomes completely obstructed a progressive hydrocephalus will cause a fatal outcome.

The existence of primary tumors of the optic nerve has long been known to ophthalmologists, but under a variety of names. Von Graefe [2] in 1864 first reviewed and summarized the facts then known about sheath tumors, but in 1879 Willemer [3] differentiated the tumors arising

2. Von Graefe: Zur Kasuistik der Tumoren, Graefe's Arch. f. Ophth. **10**: 193, 1865.

3. Willemer, F.: Ueber eigentliche das heisst sich innerhalb der äusseren Scheide entwickelnde Tumoren des Sehnerven, Graefe's Arch. f. Ophth. **25**:189, 1879.

from the optic nerve from the less frequent extraneural tumors. Yet the fundamental histology of these neoplasms was long a mystery, as evidenced by the variety of names by which they have been designated. Such terms as fibroma, fibrosarcoma, myxoma, neuroma, glioma and combinations of them have been applied to tumors arising from the same anatomic structure. Hudson [4] recognized the two general types of tumors involving the optic nerve, but Verhoeff [5] first clearly described the histology of the growths arising from the neural tissue, recognized them as gliomas and differentiated them from the sheath tumors.

These tumors are relatively infrequent, so that Hudson found only 118 cases in the literature in 1912. Martin and Cushing [6] found 7 gliomas of the intracranial portion of the optic nerves in 826 histologically verified tumors, an incidence of about 0.84 per cent of all intracranial neoplasms and about 2 per cent of all their gliomas. Twenty per cent of Hudson's cases involved both the intra-orbital and the intracranial portions of the nerve. Although intra-orbital tumors may be present without extension into the cranial cavity, a pure intracranial tumor without extension into the orbit is rare. The growth may arise spontaneously throughout the course of the nerve or infiltrate along it. Multiple foci of origin probably do not exist. The point of origin is close to the optic foramen, which is dilated early, a diagnostic point utilizable by means of special roentgenologic technic. Extension forward into the orbit causes a painless exophthalmos with very little early limitation of ocular movement. Erosion of the orbital structures takes place with the increasing size of the tumor. Vision is gradually lost, and the optic disk head presents the appearance of a primary optic atrophy, except when interference with the blood supply causes engorgement and edema. When the tumor arises from the chiasm only a diminution of vision and changes in the optic disk are found, but secondary extension to the orbit brings on exophthalmos. Extension along the base of the brain produces a variety of symptoms, depending on the structures involved. Pure intra-orbital tumors may be cured by complete enucleation, but intracranial involvement unfortunately can be treated only by deep roentgen therapy, as operative intervention almost invariably causes death with hyperthermia.

Grossly, the tumor is spindle-shaped, fairly smooth on its surface and covered by easily detached dura. It may reach a size of from 1 to 2.5 cm. in diameter. The neoplasm can consist of a solitary spherical

4. Hudson, A. C.: Primary Tumors of the Optic Nerve, Roy. London Ophth. Hosp. Rep. **18**:317, 1912.

5. Verhoeff, F.: Primary Intraneural Tumors (Gliomas) of the Optic Nerve, Arch. Ophth. **51**:120, 1922.

6. Martin, P., and Cushing, H.: Primary Gliomas of the Chiasm and Optic Nerves, Arch. Ophth. **52**:209, 1922.

enlargement of the optic nerve (fig. 2), a solid, irregular thickening along its entire course or, more frequently, several small nodules separated by thick tubular tissue. Although the overlying dura is usually normal, it may be thinned and contain tumor tissue on its inner surface, but it is rarely penetrated. The cut surfaces of the mass reveal either a diffusely thickened optic nerve still recognizable as such, or a grayish-red tumor nodule with the optic nerve apparently compressed eccentrically to the periphery into a sickle-shaped remnant. The consistency is somewhat elastic. Frequently large cysts filled with slimy mucoid material are found.

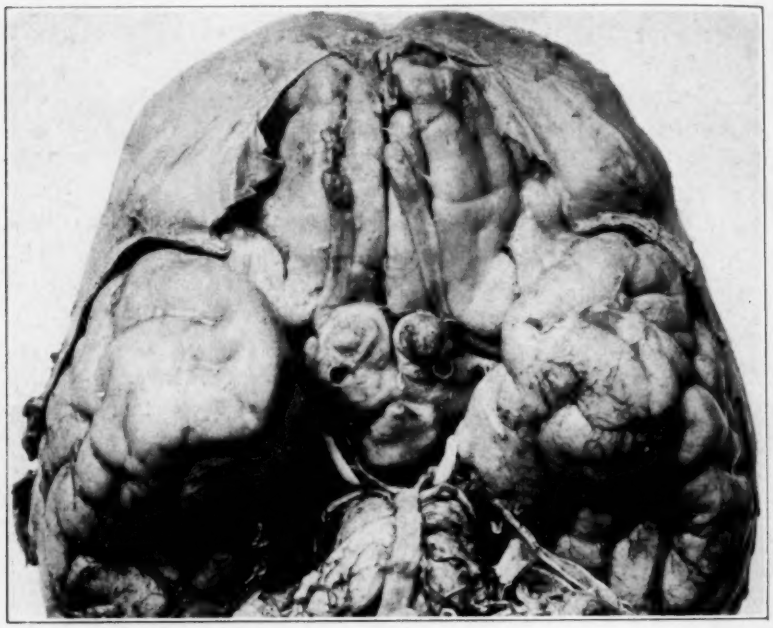


Fig. 2.—The gross appearance of a glioma of the optic chiasm. The optic nerves lead into the mass which has extended backward to involve the floor of the third ventricle. (After Martin and Cushing.)

The condition of the pia-arachnoid and its prolongations into the nerve as septums vary considerably. Occasionally, the septums are thinned and spread apart by the tumor structure of the interseptal spaces. Then there may be only fine perivascular strands of collagenous connective tissue, frequently broken, as the sole remnant of sheath or septums, with broad bands of tumor cells between them (fig. 3). Even the remnants of the septums may be invaded by tumor cells. More frequently, however, the pia-arachnoid and septums are tremendously thickened. In its growth the former may exceed the size of the glioma and at first

glance may seem to be the tumor itself. This thickening may continue beyond the tumor enlargement of the nerve and compress the nontumorous portion of the optic fibers. Thus there may almost be said to be two tumors, one of sheath structures, the other a glioma. The thickened septums are composed of irregular masses of collagenous tissue into which glia fibers have grown in all directions.

The exuberant growth tendencies of the connective tissue elements have given rise to much conjecture, especially in view of the frequent association of gliomas of the optic nerve with peripheral von Recklinghausen's disease. Michel [7] first noted this coincidence, and Emanuel,[8]

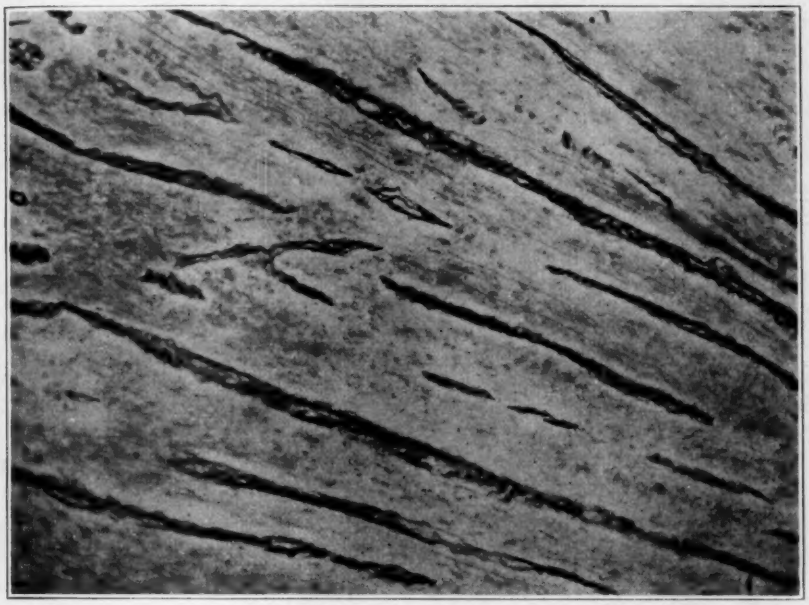


Fig. 3.—Remnants of the septums in a chiasmal tumor. The fine strands of collagenous connective tissue, frequently broken, separate broad bands of tumor tissue. Perdrau method; × 120.

in reporting a case associated with molluscum fibrosum, considered the sheath tumor a neurofibroma analogous to the peripheral neurofibromas. Martin and Cushing's case 7 was an example of the association of a chiasmal glioma and cutaneous neurofibromatosis, and there has been such a case at the Billings Hospital verified by operation. Von

7. Michel, J.: Ueber eine Hyperplasie des Chiasma und des rechten Nervus opticus bei Elephantiasis, Graefe's Arch. f. Ophth. **19**:145, 1873.

8. Emanuel, C.: Ueber die Beziehungen der Sehnerven-Geschwülste zur Elephantiasis neuromatodes und über Sehnervengliom, Graefe's Arch. f. Ophth. **53**:129, 1912.

Hippel [9] considered that in these cases there is an inherent growth tendency in both glial and mesodermal tissues. Verhoeff, however, expressed the belief that either the arachnoid growth is a result of the mechanical distention of the sheath and septums by the growing glioma or the glioma in some manner has a stimulating effect on the sheath cells (also Kiel [10]).

It cannot be denied that the associated proliferation of the sheath is peculiar to the optic nerve, since cerebral gliomas do not cause the same reaction in the meninges, yet rarely could they stretch the pia-arachnoid as can the closely enveloped gliomas of the optic nerve. The mechanism of this peculiar proliferation is not clear; yet it is in all probability secondary to the primary glioma. Furthermore, the association of peripheral neurofibromatosis with gliomas of the optic nerve is a well established clinical fact which cannot be explained any more than the association of the former with tumors of the intramedullary cord, and one's ignorance must be expressed by considering the relationship of several tumor types as a sign of constitutional (anlage) defect.

The fibers of the optic nerve are spread apart by the tumor and demyelinized early, although occasionally a myelin sheath may persist, and small, normal-appearing bundles of axis cylinders may remain intact in the peripherally compressed remnant of optic nerve. The tumor is usually not very vascular, although the septums may contain numerous thin-walled dilated vessels. There is a marked tendency to hyalinization of the walls of the blood vessels, and secondary hemorrhages are not infrequent. Small degenerative cysts occur constantly and contain a homogeneous substance which previously was considered as mucin, hence the old term myxoma, but which, according to Fleischer and Scheerer [11] and Sattler,[12] does not stain with mucincarmine or mucinhematin. Larger cysts may appear; in fact, the entire tumor may comprise a cyst, as in Adamuck's [13] case. When the tumor infiltrates to the papilla, as in Sattler's and Verhoeff's cases, it may be visible ophthalmoscopically as a small papillary cyst. Verhoeff expressed the belief that the small cysts containing serous fluid, small amounts of fibrin and a few red cells arise from a fusion of the vacuoles found in the reticu-

9. Von Hippel, E., in Graefe-Saemisch: Handbuch der gesamten Augenheilkunde, Berlin, Julius Springer, 1923, vol. 7 B.

10. Kiel, E.: Zur Histologie der Opticustumoren, Graefe's Arch. f. Ophth. **112**:64, 1924.

11. Fleischer and Scheerer: Beiträge zur Histologie der primären Sehnerventumoren, Graefe's Arch. f. Ophth. **103**:46, 1920.

12. Sattler, H.: Die bösartigen Geschwülste des Auges, Leipzig, S. Hirzel, 1925.

13. Adamuck, S.: Zwei Fälle von Neubildungen des Nervus opticus und der Orbita, Arch. f. Augenh. **28**:129, 1894.

lum. Löhlein [14] expressed the opinion that the cysts arise from areas of degeneration secondary to the marked degenerative and hyaline changes of the walls of the vessels. The latter explanation seems more probable. Degeneration of the tumor without cyst formation may be found in areas distant from the blood vessels, as evidenced by a faint homogeneous staining of the tissue.

Throughout the literature, although only ordinary nuclear stains and teased tissue specimens were used, descriptions of the fundamental cell type have in general been the same, whether the tumor was intra-orbital or intracranial. These cells are long and spindle-shaped with oval nuclei and processes arising from each end. Sattler described the cells as oval

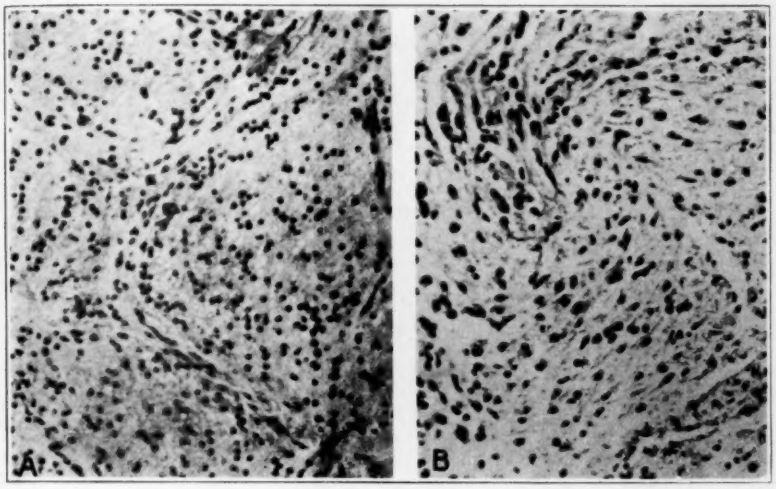


Fig. 4.—*A*, vacuolization of cells in a glioma of the optic nerve; × 150. *B*, finely reticulated type of glioma of the optic nerve, showing the elongated oval nucleated cells within the reticulum; × 150. (After Verhoeff.)

with corkscrew-like processes; Sourdille,[15] as bipolar cells with two prolongations, and Favalaro,[16] as bipolar fusiform cells with short, broad expansions forming a syncytium.

Verhoeff's description is by far the most complete. He classifies the tumors into three types, with transitions between them. One type has a finely reticulated structure with irregularly running fibrils comprising

14. Löhlein, W.: Zur Frage der primären Sehnervengeschwülste, Graefe's Arch. f. Ophth. **73**:335, 1914.

15. Sourdille: Le tumeurs neuroglia du nerf optique et de la retina, Arch. d'opht. **24**:87, 1904.

16. Favalaro, G.: Sulla morfologia comparata della neuroglia normale e neoplastica e sull' istogenese del glioma del nervo ottico umano, Ann. di ottal. e clin. ocul. **56**:619, 1928.

a matrix for small, round, oval, nucleated cells containing a small amount of feebly staining cytoplasm which is frequently vacuolated (fig. 4). Another type has a much coarser reticulum with heavier fibrils and larger intracellular vacuoles, with a tendency to more cyst formation (fig. 5 *A*). The third type contains large spindle cells with coarse neuroglia fibrils. Verhoeff also first described what he designated as cytoid bodies (fig. 5 *B*). These are rounded or elongated hyaline masses from 0.025 to 9.10 mm. in size, and seem to have a pseudonucleus which contains no chromatin or nucleolus. They stain black with phosphotungstic acid-hematoxylin after fixation in Zenker's solution and

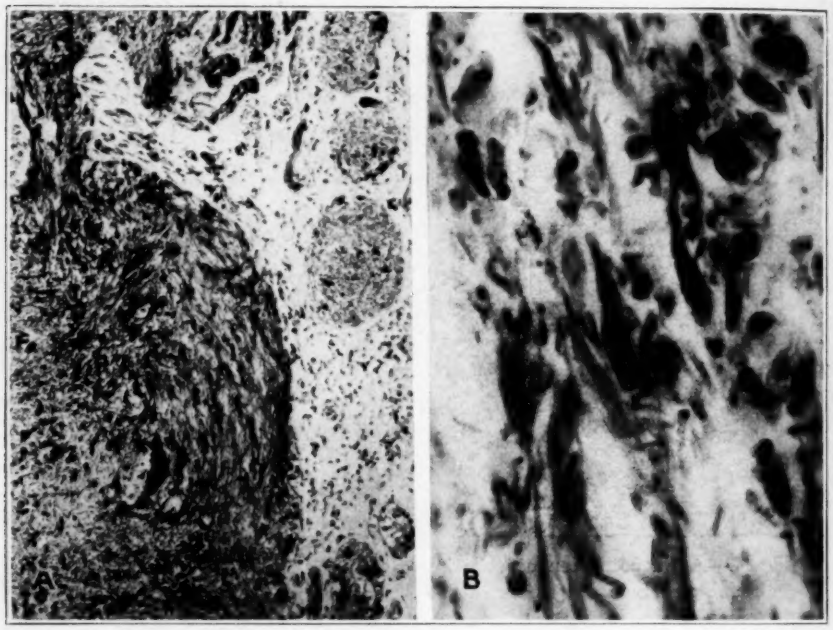


Fig. 5.—*A*, glioma of the optic nerve, with heavy coarse glia fibrils. Ethyl violet orange G stain; × 120. *B*, spongioblasts with thick tail-like processes. The dark mass in the center is a cytoid body. Ethyl violet orange G stain; × 390.

are granular. Continuous from them are long processes that may be followed into a spindle-shaped neuroglia cell. Verhoeff believes that these cytoid bodies develop through a gradual distention of the cell processes by a stainable substance and are atypical or giant neuroglia fibers. Martin and Cushing consider these bodies as simply masses of coalesced glia fibers.

The tumors contain numerous mitotic figures. Frequently, hyaline degeneration of the spindle-shaped cells is seen. Multinucleated giant tumor cells were reported by both Martin and Cushing and by Verhoeff. Large, coarse, wavy, glia fibers are abundant in some cases (fig. 6 *A*).

Favalaro found small round cells without processes but with two or more nuclei, which he considered oligodendroglia. He also found astrocytes in his tumor mixed with the bipolar fusiform cells. Cushing's case 5 was composed of small round cells surrounded by small clear spaces. These two reports are the only exceptions to the universal fusiform type of cell. They may or may not represent tumors composed of oligodendroglia, which only recently have been reported in the brain by Bailey and Bucy.[17] Only the use of more specific stains can clear up this point.

All the other tumors, however, seem to be definitely spongioblastomas (unipolare et bipolare). They follow typically the characteristic appear-

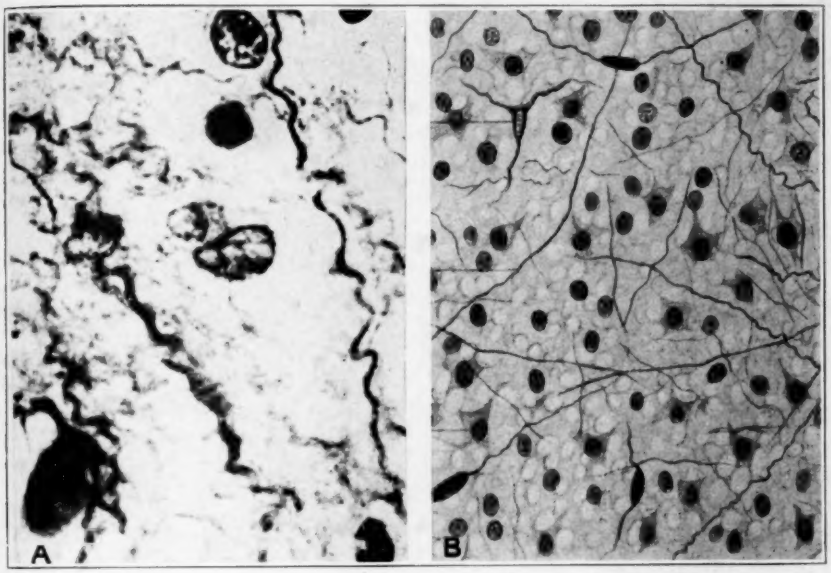


Fig. 6.—*A*, large, coarse, wavy, glia fibers in a glioma of the optic chiasm. (After Martin and Cushing.) *B*, drawing of oval bipolar spongioblasts with fine processes. (After Fischer.)

ance of this type when found in the brain. The fusiform bipolar cells (fig. 6 *B*) with delicate processes revealing frequent mitotic figures and hyaline degeneration are identical with bipolar spongioblasts. These tumors show frequent neoplastic giant cells, degenerative vascular changes and endothelial stimulation leading to vascular occlusions, cysts and hemorrhages.

The malignancy of the tumor follows the fact well established by Bailey and Cushing that the earlier the cell type in the histogenetic

17. Bailey, P., and Bucy, P. C.: Oligodendrogliomas of the Brain, J. Path. & Bact. **32**:735, 1929.

series, the more malignant is its nature. No differentiation of the spongioblasts into more adult glia in the tumors of the optic nerves has been found. Since astrocytes and oliogdendroglia have been found in the normal optic nerve by Enriquez [18] and Marchesani,[19] further developments should lead to the discovery of other tumors of the glia series arising from this nerve.

18. Enriquez, L.: Oligodendroglia de lass vias opticas, Bul. de Real Soc. Española de Historia Natural **26**:1, 1926.

19. Marchesani, O.: Die Morphologie der Glia im Nervus opticus dargestellt nach den Untersuchungsmethoden und Untersuchungsergebnissen, Graefe's Arch. f. Ophth. **117**:578, 1926.

BENIGN MELANOMA AND MELANO-EPITHELIOMA OF THE CHOROID *

HENRY P. WAGENER, M.D.
AND
WILLIAM L. A. WELLBROCK, M.D.
ROCHESTER, MINN.

The type and origin of the cells in malignant melanotic neoplasms of the choroid have long been a subject of considerable interest. More recently, the relationship between such tumors and benign melanomas or pigmented nevi has received increasing attention. The possible malignant transformation of benign melanomas has been suggested by de Schweinitz and Shumway,[1] Wolfrum,[2] Moore,[3] Heine,[4] Dawson [5] and Mulock Houwer.[6] None of these observers was able, however, to give definite proof of such transformation. Scheerer [7] stated that malignant degeneration of a melanoma of the choroid has never been observed.

Benign melanomas of the choroid are much more common than appears from a survey of the literature on ophthalmology. It seems from reported cases that malignant melanotic tumors of the choroid

* Submitted for publication, July 11, 1930.

* Read before the American Ophthalmological Society, Hot Springs, Va., June 2 to 4, 1930.

* From the Section on Ophthalmology and the Section on Surgical Pathology, the Mayo Clinic.

1. de Schweinitz, G. E., and Shumway, E. A.: Concerning Melanoma of the Choroid, with Report of One Case of This Character and of Another Exhibiting a Pigmented Sarcoma of the Choroid Early in Its Development, Tr. Am. Ophth. Soc. **10**:439, 1905.

2. Wolfrum, M.: Der Naevus der Bindehaut des Augapfel und der Aderhaut und seine Beziehungen zu den melanotischen Tumoren, Arch. f. Ophth. **71**:195, 1909.

3. Moore, R. F.: Four Cases of Melanoma of the Choroid, with a Pathological Examination in One Case, and One Case of Unusual Chronicity, After Dissemination of a Melanotic Sarcoma Had Occurred, Roy. Lond. Ophth. Hosp. Rep. **19**: 411, 1914.

4. Heine, L.: Ueber Melanose und Sarkose des Augeninnern, Arch. f. Ophth. **111**:33, 1923.

5. Dawson, J. W.: The Melanomata: Their Morphology and Histogenesis, Edinburgh M. J. **32**:501 (Oct.) 1925.

6. Mulock Houwer, A. W.: On the Relation Between the So-Called Innocent Melanomata and the Malignant Tumors of the Choroid, Tr. Ophth. Soc. U. Kingdom **48**:167, 1928.

7. Scheerer, Richard: Melanosis choroideae, Ergebn. d. allg. Path. u. path. Anat. **21**:91, 1928.

are more common than benign tumors. Schappert-Kimmyser [8] investigated histologically the occurrence of benign melanomas in eyes with and without sarcomas. She found five separate melanomas in fifty sarcomatous eyes and two in fifty nonsarcomatous eyes. With reference to the relative frequency of melanomas and melanosarcomas, she quoted Kraupa [9] as stating that in six years he had observed ten benign melanomas and had removed five eyes for melanosarcomas.

The ophthalmoscopic appearance of a benign melanoma of the choroid was well described by Moore. The flat, slate gray or "blue ointment" colored patch, usually measuring approximately 1 disk in diameter, may be easily overlooked unless it is carefully searched for, especially in a heavily pigmented choroid. Since becoming interested in them, we have observed them much oftener than formerly. A benign melanoma is seen on the average in at least one of every 100 patients without complaints referable to the eye. We are convinced that the benign melanomas of the choroid are more common than is usually supposed, and that they are common enough to be regarded as the source of malignant melanotic tumors, though Fuchs [10] was of the opposite opinion.

Histologically, benign melanomas of the choroid have been commonly considered as massed collections of normal chromatophores of the choroid, as Moore, Usher [11] and Johnston [12] described them. Velhagen,[13] however, called attention to the spindle-shaped bodies of the cells and to the fact that they differ from the normal pigment cells of the choroid in that they have no processes or only very short ones. Schappert-Kimmyser and Mulock Houwer [14] expressed the belief that the cases reported as melanomas and as "smallest sarcomas" are all really melanomas and that they belong to the group of nevi since some of the cells are similar to atypical nevus cells described in nevi of the skin, especially by Gans. They believed, however, that the nevus-like cells of the melanomas, unlike those of the skin, are of mesodermal origin, and that basically they are the chromatophores of the choroid.

---

8. Schappert-Kimmyser, J.: Die Frequenz der sogenannten Uvealmelanome in Augen mit und ohne Sarkom, Arch. f. Augenh. **100-101**:46, 1929.

9. Kraupa, E., quoted by Schappert-Kimmyser (footnote 8).

10. Fuchs, E., quoted by Schappert-Kimmyser (footnote 8).

11. Usher, C. H.: Melanoma of Choroid, Tr. Ophth. Soc. U. Kingdom **46**: 131, 1926.

12. Johnston, K. B.: The Ophthalmoscopic Picture of Naevus (Melanoma) Choroideae, Brit. J. Ophth. **13**:498 (Oct.) 1929.

13. Velhagen, C.: Ein Melanom und sogenannte kleinstes Sarkom der Choroidea in demselben Augapfel, Klin. Monatsbl. f. Augenh. **80**:73, 1928.

14. Schappert-Kimmyser, J., and Mulock Houwer, A. W.: Melanoma und kleinste Sarkome, Arch. f. Augenh. **100-101**:21, 1929.

In the course of a general examination of the patient whose enucleated eye forms the subject of this report, a localized area of increased pigmentation of the choroid was observed which in no wise differed from the patches usually diagnosed as benign melanomas. It did not show elevation or signs of activity. For four years after the observation, it did not give evidence of extension or of injury to the eye. Then a rapidly growing malignant melanotic neoplasm at the approximate site of the melanoma necessitated removal of the eye. It might be argued that the area originally seen was in reality a commencing malignant tumor. Its ophthalmoscopic appearance, however, did not suggest this fact, and the histologic examination of the enucleated eye revealed the presence of a definite preexisting benign melanoma within which the malignant growth began.

REPORT OF A CASE

A woman, aged 52, came to the clinic for the first time on July 30, 1925, complaining of dizziness and pain in the back which had been present at intervals for over a period of two or three years. Three weeks before admission she had an attack of dizziness and nausea which had persisted for ten days. For several years she had had migrainous headaches; she had also had a few attacks of blurred vision, which lasted for about half an hour, and which was associated with aphasia. These attacks had become more infrequent recently. Examination gave negative results, except for the presence of two infected teeth and hypertrophied and infected tonsils. Diagnoses of migraine, cerebral arteriosclerosis and toxic vertigo were made. The infected tonsils and teeth were removed.

Examination of the eyes at this time showed vision of 6/6 in each eye with the proper correcting lenses, and normal external ocular structures, pupils, reflexes and visual fields. The fundi were normal except that in the right eye, near the macula, there was a patch of increased pigmentation of the choroid, which was regarded as a benign melanoma.

Four years later, Oct. 5, 1929, the patient returned to the clinic with the complaint of reduced vision in the right eye. She stated that the vision in this eye had been rather poor for three or four years. Ten months previous to admission, however, vision had commenced to fail rapidly, and this condition had progressed so that now only a little sight remained in the lower part of the visual field. There had been no pain in the eye. The vision of the right eye was limited to the ability to count fingers at 2 feet (60.96 cm.); that of the left eye was 6/10. There was a large scotoma in the upper field of vision of the right eye. The external ocular structures were normal. The fundus of the left eye was normal but in the right eye there was a deeply pigmented mass measuring about 4 disk diameters and 8 diopters in height, situated temporal to the optic disk and below the macula. The retina was elevated over this mass, but apparently lay in direct contact with it at its upper portion. Below the mass, a serous detachment of the retina extended toward the lower periphery. A recent hemorrhage was seen in the retina along the upper border of the detachment. Transillumination of the eye revealed a dark area at the site of the mass. A diagnosis of a malignant melanotic tumor of the choroid was made, and the eye was enucleated.

The eye was studied by serial celloidin sections stained with hematoxylin and eosin. The tumor was first seen as a small group of epithelial cells lying within a large pigmented mole. It increased in size rather rapidly, but for a time it was circum-

scribed and surrounded by the heavily pigmented cells of the mole (fig. 1). Later it became somewhat mushroom in shape by growing out into the vitreous chamber of the eye. Following the laws of growth, its cells proliferated in the direction of least resistance, which was at first equal in all directions. Soon, however, greater resistance was manifested on the side of the sclera. Hence the tumor became roughly elliptical. This mode of advance continued until the lamina vitrea was burst. Proliferation became active in this direction at the hole in Bruch's membrane, and a new focus was established in the subretinal space. Here again resistences were equalized, growth proceeded equally in all directions, and a globular head of the tumor was formed. This mass continued to enlarge and finally emerged as one large tumor which began its growth lateral to the optic nerve and finally surrounded it. Its greatest diameter was 7 mm. The tumor was blackish brown.

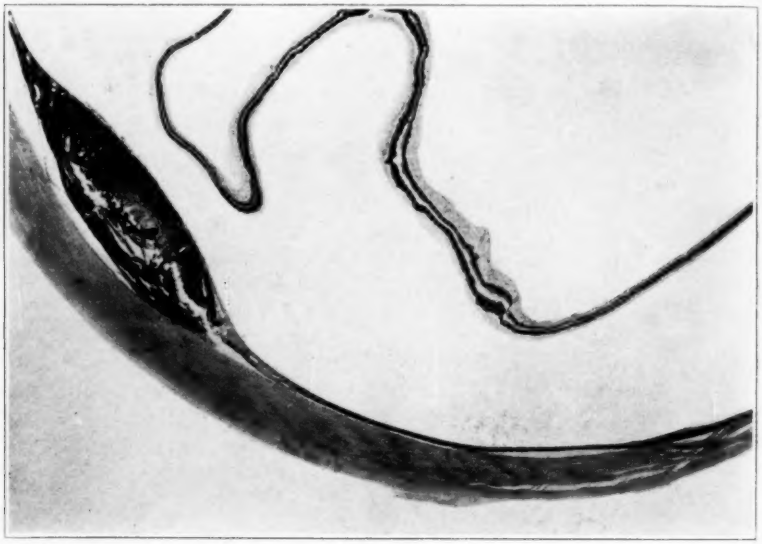


Fig. 1.—Melano-epithelioma and benign mole in choroid; × 10.

Microscopically, the tumor consisted of small oval and spindle-shaped epithelial cells. The nuclei stained a deep blue, and the cytoplasm was not visible. Many of the cells contained multiple nucleoli which were not large or hyperchromatic. Scattered throughout the tumor were a few mitotic figures (fig. 2). Many of the cells contained a golden-brown granular pigment similar to that seen in the pigment-bearing cells of the retina and choroid. Vascular spaces were numerous, and the arrangement of the tumor cells about these spaces was that of a so-called perithelioma. In the choroid, about midway between the optic disk and the ciliary body, on the opposite side from the main tumor, was a small flat mass composed of epithelial cells, mainly nonpigmented, although a small amount of pigment was present in the mass. Apparently, this was a benign tumor; absence of active growth was shown especially by the absence of mitotic figures and multiple nucleoli. This was regarded as an essentially nonpigmented mole. Its characteristics were similar to those of the tumor described by Velhagen as "smallest sarcoma."

COMMENT

Broders and MacCarty [15] stated that melano-epithelioma of the skin arises as migratory hyperplasia of the basal layer of the skin, and that it invades the subcutaneous tissues and distal organs as pigmented and nonpigmented oval, spherical or spindle cells, all of which are frequently found in the same specimen. Dawson [5] found that the basal cells of the epidermis were the true pigment producers and traced the origin of the quiescent nevus cells from the basal epithelium by a process of emigration and depigmentation. He disposed of the difficulty of explaining malignant uveal melanomas by the assumption that the pigmented cells of the choroid are embryologically derived from the pigmented

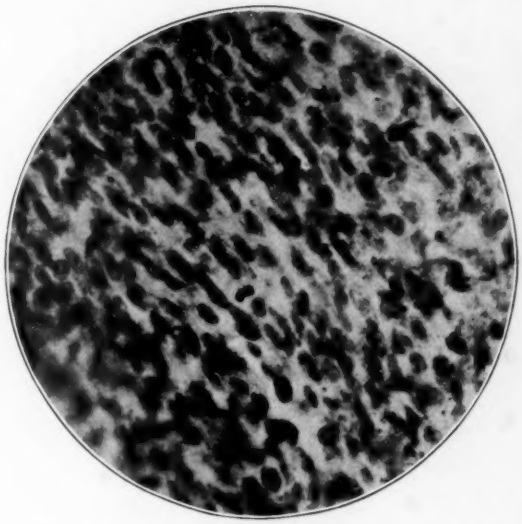


Fig. 2.—Cells of melano-epithelioma; × 400.

epithelium of the retina. Leber [16] expressed the belief that malignant uveal melanomas arise from the retinal pigment epithelium, since he found the epithelial cells of this layer in active proliferation, and since he regarded the production of the hematogenous pigmentation of these tumors as a property of the pigment epithelial cells and not of the choroidal stroma cells. Such an origin, however, can rarely be traced. Early melanotic sarcomas have been traced by Fuchs [17] to the pigmented cells of the choroid, while the retinal pigment epithelium was intact.

15. Broders, A. C., and MacCarty, W. C.: Melano-Epithelioma: A Report of Seventy Cases, Surg. Gynec. Obst. **23**:28 (July) 1916.

16. Leber, Theodore: Ueber die Aderhautsarkome und die Herkunft ihres Pigmentes, Arch. f. Ophth. **43**:683, 1897.

17. Fuchs, E., quoted by Ewing, James: Neoplastic Diseases, ed. 2, Philadelphia, W. B. Saunders Company, 1922, p. 883.

It is generally considered that the choroid is mesodermal in origin, and that the choroidal pigment is not derived from the pigment layer of the retina. Mann [18] expressed this as her belief, for the reason that pigment appears in the retinal epithelium at five weeks, and this layer is completely differentiated long before any pigment can be seen in the choroid, where, in her opinion, it first appears at five months, uniformly scattered in the protoplasm of branched connective tissue cells or chromatophores. These are found first in the outer layers of the choroid whence they spread inward, so that there seems to be no question of migration outward from the retinal epithelium. This is a strong point in favor of the theory of the mesodermal origin of the pigmented neoplasms of the choroid which must apparently arise from

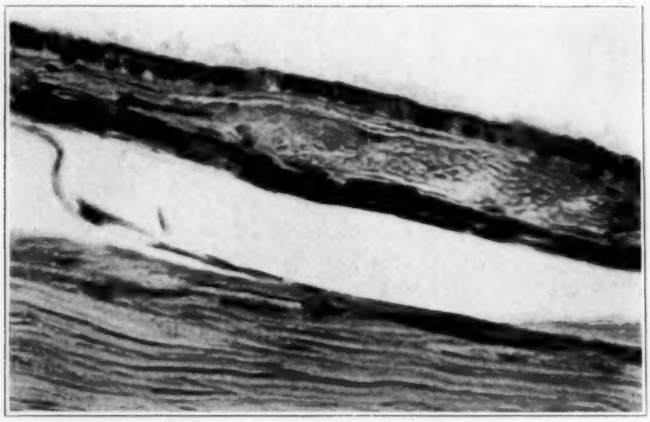


Fig. 3.—Two layers of choroid epithelium; × 300.

the chromatophores, since the membrane of Bruch is found intact over them, separating them from the retinal pigment epithelium. Collins [19] claimed that the melanoblasts are both epiblastic and mesoblastic in origin. Knight,[20] who reported seven cases, considered these tumors to be epithelial in origin. He reasoned that only ectodermal cells produce melanin. The intracellular production of melanin is then a point in favor of the epitheliomatous rather than sarcomatous nature of these tumors.

18. Mann, I. C.: Discussion on Intra- and Extra-Ocular Melanomata, Tr. Ophth. Soc. U. Kingdom **46**:132, 1926.

19. Collins, E. T.: Discussion on Intra- and Extra-Ocular Melanomata, Tr. Ophth. Soc. U. Kingdom **46**:86, 1926.

20. Knight, M. S.: Melanotic Neoplasms of the Eye, J. A. M. A. **83**:1062 (Oct. 4) 1924.

In the development of the eye the inner layer of the optic cup differentiates into the neuro-epithelial layer, and the outer layer differentiates into the basal or pigment epithelial layer of the retina. It is our belief that this pigment epithelium is split into two layers by the ingrowing vascular tissue of the choroid, and that a layer of pigment epithelium is thus reduced on both retinal and scleral sides of the choroid (fig. 3). The pigmented cells that are first seen embryologically in the outer layers of the choroid must represent this outer epithelial layer, and it is from this choroidal pigmented epithelium that the malignant melanotic tumors of the choroid arise. We have observed benign pigmented and nonpigmented tumors in the choroid that occur as do pigmented and nonpigmented moles in the skin, and both are subject to malignant transformation. The tumor in our case undoubtedly began in a benign pigmented mole or melanoma.

In the choroid there are seen two types of cells that contain a golden-brown, granular pigment. The first type is the epithelial spindle-shaped or oval-shaped cell, which contains and produces in its protoplasm the metabolic substance known as melanin. The second type is the so-called chromatophore, which is a branched phagocytic reticular endothelial cell. It contains the same pigment but has a foreign body substance thrown off by the pigmented epithelium. The benign melanoma or pigmented mole of the choroid is made up of both of these types of cells. It is the former that undergo malignant transformation and give rise to the tumor. The latter are pushed aside by the growth of the tumor and form its deeply pigmented margin.

SUMMARY

Clinically, a malignant melanotic tumor of the choroid was seen to arise at the site of a benign melanoma that had been observed four years previously. Histologically, the malignant tumor was found to have its origin in the malignant transformation of the cells in the central portion of a preexisting benign melanoma, and to consist of undifferentiated and actively growing epithelial cells. It is believed that benign melanomas of the choroid are analogous to the pigmented nevi of the skin, and that nonpigmented nevi occur in the choroid as in the skin. These pigmented nevi of the choroid consist in part of pigmented connective tissue cells or chromatophores, and in part of epithelial cells that are apparently derived from the pigmented epithelium of the external layer of the secondary optic vesicle by a process of splitting off during the ingrowth of the vascular tissues of the choroid. It is in these epithelial cells of the nevus that malignant transformation takes place. Hence the malignant melanotic tumors of the choroid, or at least those that have their origin in benign melanomas, should be designated melano-epitheliomas.

PARALYSIS OF AN EXTRA-OCULAR MUSCLE AFTER SPINAL ANESTHESIA *

JOSEPH LEVINE, M.D.
NEW YORK

For almost thirty years, spinal anesthesia has been used with good results on many thousands of patients. The mortality figures are usually given as 1 in 1,000, but Cahen's are 6 in 800, Vianney's 2 in 300 and Condray's 1 in 400. Complications and sequelae are rare, the most common and earliest being syncope and hypotension. Later, and more rarely, the nervous system is involved, resulting in paralysis of an extra-ocular muscle as the most common phenomenon. However, other signs of involvement of the nervous system are tetanic contractures, anesthesia, hyperesthesia, anxiety neurosis and hallucinations. There may be headache, backache, vomiting, neuralgia or paresthesia, or blurring of vision and scintillating scotomas may be the forerunners of a muscle weakness. The latter may not be marked at first, but usually becomes more severe quickly and takes several months to clear up entirely. In some cases, paralysis of the muscle is but the first of many signs pointing to a meningitis which may prove fatal. The nerve most commonly affected is the abducens; optic, facial and sympathetic involvement are rare, only two cases of each having been reported.

Blatt [1] saw two cases of paralysis of an extra-ocular muscle after spinal anesthesia in 1918, and since then has seen two more. In reviewing the histories of eighty-eight similar cases, he found oculomotor paralysis with external ophthalmoplegia in six cases, with myosis in one and with mydriasis in four. There were four cases of trochlear involvement, three on the left side and one on the right. All the other seventy-eight cases were abducens paralysis, eighteen being bilateral and sixty one sided; which side was more often affected was not stated. The onset was found to vary from three days to three weeks after the spinal anesthesia was given, and the paralysis cleared up in from one week to three months, although in 10 per cent of the cases it took from four to seven months. One case lasted nine months, but the other signs of central and peripheral nerve lesions persisted; in still another case, it was sixteen months before the condition cleared up.

---

* Submitted for publication, July 14, 1930.

1. Blatt, Nick: Ocular Paralysis After Spinal Anesthesia, Wien. med. Wchnschr. **79**:1391, 1929.

Mühsam [2] saw six cases, in five of which the sixth nerve was involved and in one the fourth nerve; Landow [3] reported a case of bilateral paralysis of the sixth nerve; Mingazzini reported a case of almost complete bilateral ophthalmoplegia externa; Scheppens,[4] a case of left abducens paralysis; Gontermann,[5] one of bilateral abducens paralysis coming on eight days after the anesthesia was given, with recovery in six weeks. Fernandez Balbuena [6] reported a case of left abducens paralysis which started two weeks after anesthesia was given and lasted two months; Dameno [7] reported four cases of external rectus involvement which started a few days after the administration of procaine hydrochloride as lumbar anesthesia, with recovery in three weeks. Merle and Frogé [8] reported a case of abducens paralysis which developed in six days, and disappeared eight days after the anesthesia was given. Moore [9] also reported a case, and Reber,[10] reporting to the Section on Ophthalmology of the American Medical Association in 1910, stated that among 2,000 cases in which lumbar anesthesia was given he encountered 5 cases of paralysis of one or both external recti; both were affected in 3 and one in the other 2 cases. Four of these patients recovered; at the time of the report the other had not yet recovered.

There are various theories as to the causative factor in these cases of paralysis. Blanluet and Caron [11] attributed it to an elective toxic action, a localized hemorrhage or a mild meningeal infection. Bonnier [12]

2. Mühsam, W.: Oculomotor Paralysis After Anesthesia by Lumbar Puncture, Deutsche med. Wchnschr. **32**:1411, 1906.

3. Landow: Case of Bilateral Paralysis of Abducens After Spinal Anesthesia, München. med. Wchnschr. **53**:1464, 1906.

4. Scheppens, L.: Paralysis of the Sixth Nerve Following Lumbar Anesthesia, Clin. opht. **14**:353, 1908.

5. Gontermann, C.: Paralysis of the Sixth Nerve After Lumbar Anesthesia with Tropococain, Berl. klin. Wchnschr. **45**:1523, 1908; abstr., Ophthalmic Year Book, 1909.

6. Balbuena, Fernandez: Paralysis of External Rectus Following Spinal Anesthesia by Stovain, Arch. d'opht. **15**:422, 1914.

7. Dameno, E.: Ocular Paralysis After Intraspinal Anesthesia, Prenza méd. argent. **4**:417, 1918; abstr., J. A. M. A. **71**:77 (July 6) 1918.

8. Merle, P., and Frogé: Transitory Diplopia After Lumbar Puncture, Ann. d'ocul. **160**:24, 1923.

9. Moore, R. F.: Ocular Palsies, Brit. J. Ophth. **5**:347, 1921.

10. Reber, W.: Ocular Palsies Associated with Induction of Spinal Anesthesia, Tr. Sec. Ophth., A. M. A. **71**:225, 1910.

11. Blanluet and Caron: Abducens Paralysis After Stovain Anesthesia by Lumbar Puncture, Ann. d'ocul. **137**:62, 1907.

12. Bonnier, P.: Oculomotor Disturbances with Anesthesia by Lumbar Puncture, Ann. d'ocul. **138**:67, 1907.

believed that the fluid injected into the spinal canal reaches the cavity of the labyrinth and there comes into the closest contact with the nervous mechanism of the ear, which irritation then involves a motor nerve of the eye, of which the sixth is most frequently affected. Schmidt-Rimpler [13] argued that the sixth nerve is most frequently involved because of its superficial position in the fourth ventricle; the latter communicates through the foramen of Magendie and the lateral apertures with the arachnoid space of the cord which carries the anesthetizing fluid. Furthermore, involvement of the roots of the vagus and glossopharyngeus, which also have a superficial position, is not rare. In this connection he also pointed out that the delayed onset of the paralysis is analogous to postdiphtheritic palsies in which the toxins do not act until several weeks after recovery from the primary disease. Schubens,[14] in reporting a case of bilateral abducens paralysis and choked disk after procaine hydrochloride-epinephrine lumbar anesthesia, is of the opinion that the causative factor is the irritation of the meninges by the products of catabolism of the procaine hydrochloride epinephrine solution.

Lagrange and Pesme [15] reported a case of a woman, aged 39, in whom paralysis of the right external rectus with miosis occurred after spinal anesthesia. She had a positive Wassermann reaction of the blood but a negative reaction of the spinal fluid. They thought that the injection stirred up a low grade meningitis in a syphilitic patient, and agreed with Terrien and Prélat that meningitis should be ruled out before blaming the toxic action of the anesthetic as the cause of the paralysis. In this connection, Ricci's [16] experience is of interest. He was able to collect ninety-two cases from the literature, and saw one himself. In his patient, there was paralysis of the left external rectus with bilateral amblyopia and micropsia. The patient had a history of symptoms which made Ricci think that an old chronic serous meningitis had been activated by the spinal injection.

Barnes,[17] in discussing ocular paralysis, stated that "any disease causing intracranial pressure increase may cause complete or incomplete paralysis of any ocular nerve, but the sixth suffers most

13. Schmidt-Rimpler, H.: Paralysis of Ocular Muscles After Lumbar Anesthesia, Klin. Monatsbl. f. Augenh. **4**:116, 1907.

14. Schubens, A.: Bilateral Abducens Paralysis and Choked Disc After Novocain-Suprarenin Lumbar Anesthesia, Klin. Monatsbl. f. Augenh. **70**:154, 1923.

15. Lagrange, H., and Pesme, P.: Oculomotor Paralysis with Anisocoria and Miosis After Spinal Anesthesia, Arch. d'ophth. **39**:503, 1922.

16. Ricci, E.: Paralysis of Externus, Amblyopia and Micropsia, Following Spinal Anesthesia, Lettura Oftal., December, 1925, p. 564; abstr., Ophthalmic Year Book, 1927.

17. Barnes, S.: Ocular Paralysis, Birmingham M. Rev. **83**:232, 1912.

frequently." Wheeler,[18] in discussing Gradenigo's syndrome, and after showing the anatomic relations of the abducens nerve, made the point that the "important intimacy with the blood stream of the cavernous sinus probably accounts for the especial vulnerability of the sixth nerve to sinus infection, toxemias from many forms of infection, and the many cases of sixth nerve paralysis from spinal anesthesia." Holmes,[19] in a discussion on ocular palsies, said that in the spinal cord local collections of spinal fluid form and compress the roots of the nerves of the cord itself; similarly, loculated collections of cerebrospinal fluid might form in the base of the brain and involve one of the oculomotor nerves. At the same discussion, Harman,[20] in his paper on ocular palsies, classified them into ten groups according to their primary cause; he did not mention lumbar anesthesia as one of the causes. Blatt expressed the belief that the cause in these cases is a mechanical and toxic factor in patients with a hysterical and neuropathic constitution. He agrees with Forgue [21] that the abducens nerve is most often involved because the nucleus is basal in position and is in close contact with the arachnoid in which the toxic meningitis is localized. Blatt's paper is of further interest because in going over the case histories reported, he found that in 64 per cent stovain [22] was used, in 26 per cent procaine hydrochloride, in 7 per cent tropococaine and in 3 per cent cocaine. Stovain apparently seems to be the most common cause of these paralyses. This drug, besides acting on the sensory nerve-endings, has been shown to cause slight motor weakness also and is fairly toxic. Vogt [23] has further shown that tropococaine is being excreted from the organism three hours after the injection; procaine hydrochloride after twelve hours and stovain only after thirty hours. It is questionable whether a mixture of stovain with caffeine or strychnine makes the stovain less toxic.

REPORT OF A CASE

Miss H. H., aged 24, white, was operated on for cholecystitis and cholelithiasis on Feb. 5, 1930, under spinal anesthesia, procaine hydrochloride being used as the anesthetic. The operation was successful, and no complications occurred. On the fourth day after the operation, the patient complained of seeing double, and

18. Wheeler, J. M.: Paralysis of Sixth Cranial Nerve Associated with Otitis Media, Sec. Ophth., A. M. A., 1918, p. 51.

19. Holmes, G.: Discussion on Ocular Palsies, Proc. Roy. Soc. Med. (Sec. Neurol.) **14**:1, 1921; Lancet **1**:748 and 762 (April 9) 1921.

20. Harman, N. B.: Ocular Palsies, Proc. Roy. Soc. Med. (Sec. Neurol.) **14**:14, 1921.

21. Forgue, quoted by Blatt (footnote 1).

22. Benzoyl-dimethyl-aminoethylpropanol hydrochloride.

23. Vogt, quoted by Blatt (footnote 1).

this symptom persisted up to the time she first applied for relief at Dr. Fletcher's clinic at the Manhattan Eye, Ear and Throat Hospital. At this time it was found that there was a paralysis of the right external rectus causing the diplopia. There was a negative history as to any tendency to squint in childhood or at any other time. The vision was 20/30 in both eyes, and the refractive error under homatropine cycloplegia was corrected with + 0.75 diopter sphere, combined with + 0.50 cylinder, axis 90 in both eyes. The visual fields were normal. The blood and spinal fluid were both negative to the Wassermann and Kahn tests. The patient's general health was good, and there was no loss or gain of weight. The condition was watched at weekly intervals, but there was no improvement until April 10, when the right eye could be rotated out beyond the midline for the first time, and the patient stated that the diplopia was more apparent in certain fields of rotation. From then on improvement was rapid, and on June 21 diplopia could not be elicited with the red glass, and ocular rotation was complete in all fields. No treatment was given at any time, except prescription of a pair of glasses (+ : 50 = + : 50 × 90 for both eyes) for the psychic effect.

EXACTLY APPOSITIONAL SUTURES IN THE CATARACT OPERATION*

CLIFFORD B. WALKER, M.D.
LOS ANGELES

The operative advantages obtained in modern cataract operations by the use of morphine and scopolamine hydrobromide to remove the nervous worry and concern of the patient and by the use of procaine hydrochloride to interrupt the deep pain reflex through the ciliary ganglion, as well as to control the orbicularis and limit the movements of the eyeball, have without doubt added encouragement to the development of procedures that would have been considered too tedious or painful a decade or so ago.

This is particularly true for suturing in the cataract operation, which has been regarded by many of the best surgeons as tedious and unremunerative to the point of disadvantage and even handicap. Yet if it can be demonstrated that proper sutures actually do reduce the accidents and improve end-results, the necessary time and labor will be given to them. A list of some of the difficulties is formidable:

1. Sutures are irritating to the eye, producing redness, chemosis and scratching, so that removal often is difficult and not without risk, due to poor anesthesia and embedding of the sutures.

2. Stitch infection may become a menace if a corneal suture is used, or if gloves are not worn and a most rigid asepsis is not observed.

3. The time consumed may lead to a dry cornea and reduce the steadiness of the operator.

4. Sutures that are not in good apposition may wrinkle the cornea and actually hold the wound lips slightly apart in various ways, which is possibly worse than no suture.

5. A single suture, especially if not exactly appositional, will not guarantee against prolapse of the iris and perhaps even of the vitreous.

6. Conjunctival sutures are elastic and cut through often more rapidly than the tensile strength of the wound increases, so that scleral gaping may occur.

7. Even exactly appositional scleral sutures increase the difficulties of using the cataract knife and may require the use of the keratome and scissors, although they give most excellent results, as will be described later.

---

* Submitted for publication, June 20, 1930.

* Presented in part before the American Ophthalmological Society, June 10, 1929.

After studying and trying out many different sutures over the course of several years, the conclusion was reached that the great majority of cataract sutures were subject to the law of diminishing returns as measured by ability to improve the standard statistics or justify the labor and inconvenience involved. However, it appeared that if a condition of exact apposition of wound margins could be attained with scleral stitch that would hold without relaxing for a sufficient number of days—at least seven—a real advantage would be obtained.

Seven days is stated now as the interval, because on the sixth day I have seen the sclera open under the conjunctiva when a Kalt suture was cut. Of course, the Kalt suture is not exactly appositional and may not be a guide. Experiments are now in progress to determine the tensile strength of the scleral wound at various times after the operation.

But if one compares sclera to fascia and takes the time for development of tensile strength as determined by Howes, Sooy and Harvey,[1] five days are taken as the minimum. I have left scleral sutures in for twelve days, with no discomfort during that time. The sutures were then loose and ineffective, so that now I take them out as soon as possible after the seventh day. Cocaine gives good anesthesia then, and removal is easy.

The scleral suture to be described is novel in many features so far as I have found in the literature. The aim is to avoid the cornea, to pass through a prepared scleral pocket-flap, and to obtain thereby exact apposition of the entrance and exit of the needle passage in the cut surface of the scleral wound.

METHODS

1. The Scleral Pocket-flap Method.—The scleral pocket-flap is made after the conjunctival flap (3 mm. wide) has been dissected forward over the extent of the wound, although if an intracapsular operation is not being done, the flaps need not be dissected down to the lower angles of the wound within 5 or 6 mm., especially if scissors are used.

The first attempts in the direction of a scleral pocket-flap were mere slanting incisions a little over 1 mm. in depth made with a keratome or cataract knife with a guard, beginning almost 2 mm. back of the limbus and slanting toward the cornea, aiming to split but not to penetrate. A few lateral motions widened the margins of this incision to 1.5 or 2 mm. The same result, perhaps less uniform and wider, can

1. Howes, E. L.; Sooy, J. W., and Harvey, S. C.: Healing of Wounds as Determined by Their Tensile Strength, J. A. M. A. **92**:42 (Jan. 5) 1929.

be secured by passing a narrow cataract knife horizontally through the sclera without penetrating the chamber. But the lips of these pockets had a tendency to be too thin and weak; therefore a lip of definite thickness of the sclera was obtained with a guarded cataract knife (fig. 1*B*) by first making a horizontal cut parallel to the limbus 2 mm. back and one-third through the sclera (fig. 1*A, a*). Into this cut the tip of the keratome is readily inserted, splitting the scleral tissue horizontally toward the limbus until the tip of the instrument is barely seen through clear cornea. The pocket thus formed has practically the outline of an equilateral triangle, 2 mm. on a side. By lateral motions of the keratome, this triangular pocket is converted into an almost rectangular outline with the long side along the primary line of incision made by the guarded cataract knife. This flap retracts and elevates a little but not sufficiently for the free and easy performance of the standard corneoscleral incision with the Graefe knife. To obtain freedom to make the cataract incision exactly as usual, this pocket is converted into a flap by a cut toward the cornea with the scissors at both extremities or angles, thus producing a flap of sclera somewhat similar in shape to that on a coat pocket (fig. 1*C*).

Better apposition is obtained by placing the suture before the pocket is converted into a flap. When the needle is passed through both lips of the flap, as in fig. 1*A*, the best apposition is obtained. The needle is seen to pass in the depths of the primary incision (*a*) where later the thread is drawn up to form a 2 inch (5 cm.) loop together with the scleral flap, as shown in fig. 2*A*.

The finest curved Carrell vascular surgery needles have been found to pass through the sclera better than any other when counterpressure opposite to the direction of the needle is made with a special scleral fork, shown in fig. 2*B*. This was made by grinding down the back of an old grooved foreign body gouge or sclerotomy needle. Carrell needles will bend cold without breaking, if it is found desirable to change the curve. This was learned in experiments with fine straight needles for stringing the smallest beads. The Carrell needle has the characteristics of a short curved beading needle. The suture material used is the finest surgical twisted silk which is dry sterilized with the suction tip in case the suction method of extraction is being used, otherwise it is boiled. In any event it is allowed to become slightly oiled by contact with the petrolatum-covered corneal pledget used to protect the cornea during the operation. The depth and position of the suture in the sclera and conjunctiva is shown in fig. 1, where it may also be noted that a double surgical knot may be put on the corneal end of the single suture so that a simple pull at the other end will effect a rapid closure in case of

urgent necessity. If several sutures are placed, different colors may be used, although I have used only white and black alternating to make orientation easier. The sutures radiate perpendicular to the limbus, because better apposition and circulation result.

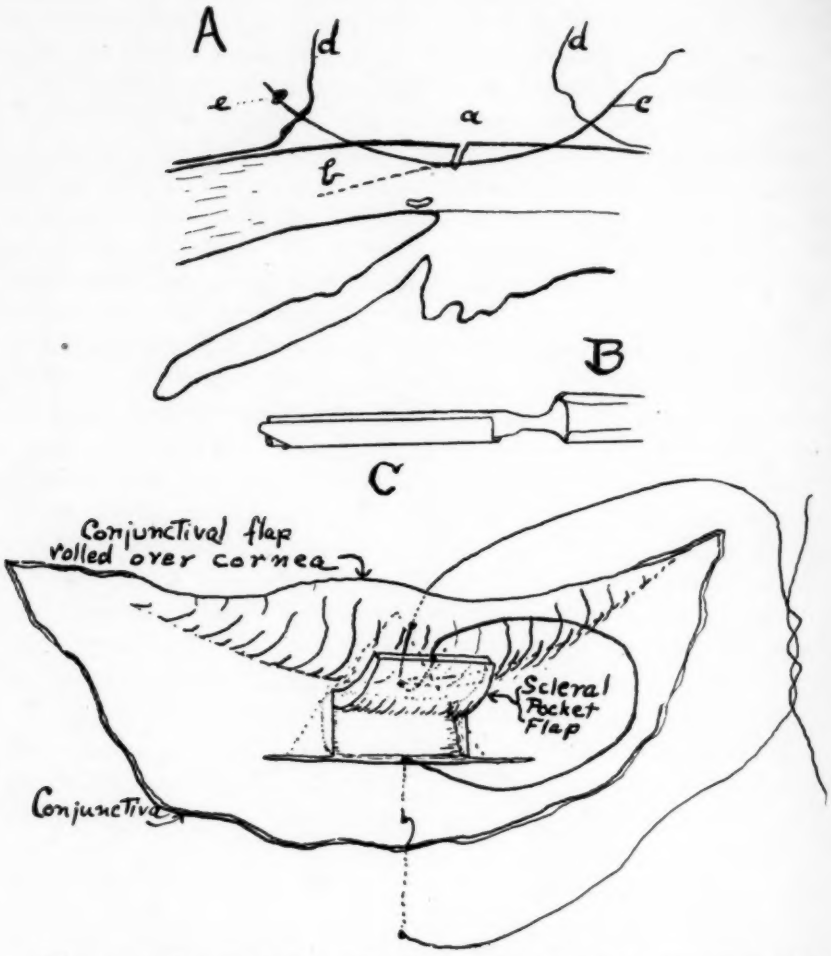


Fig. 1.—*A*, diagram (scale 1:10) showing (*a*) primary incision by guarded cataract knife; (*b*) keratome incision for scleral pocket; (*c*) course of needle and thread through (*d*) conjunctival flaps and sclera; (*e*) knot, double surgical or bowed, or not used at all if not desired; *B*, guarded cataract knife; *C*, front view of *A*.

2. *Alternative Method.*—If a scleral pocket alone or if just the simple primary incision is used, the appositional points are so close together that the incision must be started between them with the kera-

tome and continued laterally with the scissors. If the scleral stitch is good, any irregularities of wound margins seem to act as an advantage, giving a strong dovetailing and rapidly healing wound, just as good or better than the smooth wound if the latter has the slightest tendency to gape. With this method there is no danger of engaging the iris during the incision and the wound is made just the desired width. The apposition by this method is better than with the scleral flap formation, but the classic Graefe corneoscleral incision is too difficult to use with it.

Of course, as I first started to do, one may use a double-armored suture, passing the needles through the lips of the pocket outward in

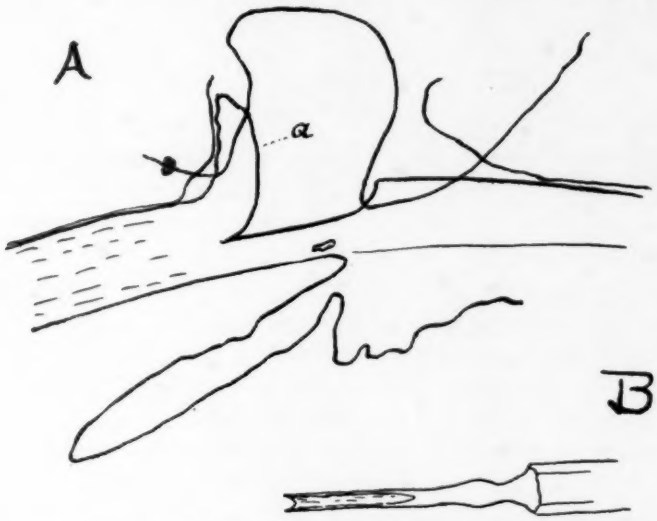


Fig. 2.—*A,* showing (*a*) scleral flap and suture elevated and ready either for cataract knife or keratome incision; in this space a piece of transparent material may be inserted to guard suture if desired; *B,* scleral fixation instrument.

opposite directions; in that case even a pocket may be omitted, just a drill hole being made with a fine dental burr or a slight nick with the guarded knife as a starting point. In fact, I have even attempted to use the first needle hole as the starting point of the second needle as in the Verhoeff stitch but found it to be more difficult and less appositional, largely because with the fine sharp needle it is easy to miss the exit hole a little, and if it does enter the small hole, it easily picks up a few shreds of the thread already there.

If the double armored suture is used on the scleral flap it will be found to be considerably the easiest method but perhaps less appositional,

so that if a marked side-slip is produced a slight tendency to subconjunctival fistula may be noted for a week or so, a miniature bleb after the manner of the Elliot operation. This bleb has never been seen to give any trouble and soon disappears, leaving no traces. Sometimes it seems to be helpful in cases with a glaucomatous tendency. I have taken advantage of this fact. In a patient who had had an iridectomy for glaucoma, I offset the apposition a little vertically; slightly trimming the lateral margins of the scleral flap, I obtained a filtrating bleb suture that held the wound together until healing was complete, with no tendency to gaping of the wound because of tension.

The combination of ordinary thread which has been boiled and a pledget of salt solution on the cornea is apt to give trouble, because the boiling roughens the silk and the salt seems to aggravate this condition, so that it saws when drawn through and also draws in conjunctiva readily. The action of the salt solution as it warms, evaporates and concentrates on the cornea may later produce a disturbance that is not seen when an ointment pledget is used. Any thread works better when oiled, although 00 surgical silk, dry sterilized, is the best.

Any method of reducing the tension of the eye should be avoided before the scleral sutures are all placed, because the difficulty of introducing them increases rapidly with the lowering of the tension; for instance, if epinephrine is to be injected separately it should be done after at least the central scleral stitch has been successfully placed.

Again, after all stitches were in place, in cases in which fluid vitreous was suspected, I performed a vitreous aspiration of 0.1 cc., which not only lowers the tension but also gives more definite information of the vitreous condition. It must be emphasized that this has been done only in selected cases in which loss of vitreous is quite certain. In one striking case a cataractous lens was dislocated forward through an old iridectomy for glaucoma. The anterior chamber was fully occupied by the lens, and the tension measured 40 mm. by the Schiötz tonometer. After one central scleral and two lateral conjunctival sutures were placed, a vitreous aspiration of 0.2 cc. with a lancet-tippped needle was done just in front of the ora serrata. The vitreous was yellowish and fluid. I then made a shallow opening with a narrow cataract knife in one quadrant, passing first through the central scleral stitch. The wound was completed with the scissors and the lens extracted in capsule (Knapp method) without the slightest tendency to loss of vitreous. I have not found in the literature mention of aspiration of the vitreous being done preliminary to cataract operation, but I can recommend it when loss of vitreous is certain and a scleral stitch is used. According to Zur

Nedden [2] and others who have used aspiration of vitreous for many other purposes, vitreous apparently has considerable replacement ability.

The difficulty of putting in a scleral suture is not great, but as the number of stitches increases, the difficulties grow apace, not because of the placing of the suture, but because of the tendency for the threads to snarl about the small field. These complications and their consequences seem roughly to increase with the square of the number of stitches used. When the keratome and scissors are used to make the incision, it is not necessary to have the threads in such precise array as when the cataract knife is used in the presence of two or three scleral sutures. The looped portion of the suture extending from one lip of the pocket to the other lip may be drawn down so that it just fits over

Fig. 3.—Showing closure after incision (*a*) has been made to extract lens; (*b*) scleral flaps held in position by suture and covered by conjunctiva.

a 2 mm. roll or double fold of some of the transparent, thin, celluloid or silkoid materials, so that as the cataract knife comes through, it touches these light thread guards first and the suture is not cut. I do not recommend this unless one has unusual difficulty with the loop.

If a scleral suture is accidentally cut by any instrument, it will mean another knot and a litttle less perfect apposition, or a rethreading of one of the cut ends to the needle which is pushed through the opposite thread stump as it lies in its scleral channel, thus retracing the pathway before pulling the suture out. If it is decided to use an extra knot, then there must be thread enough left on the corneal side; if such is the case, the uncut ends are tied first, and over this the cut ends are tied where they come through the conjunctival lips.

---

2. Zur Nedden: Curative Value of Aspiration of Vitreous, Arch. Ophth. **57**:109 (March) 1928.

It may happen occasionally that injection of the orbital rim has caused some edema in a rather thickish upper lid. The usual ciliary injection may also reduce the ability of the patient to look downward. It may therefore be necessary to put a suture in the superior rectus tendon in order to draw the eye satisfactorily downward during the placing of the scleral sutures. But it must be remembered that edema of the lid may be avoided by an injection in the temporal branch of the facial nerve where it comes over the neck of the condyle of the jaw,

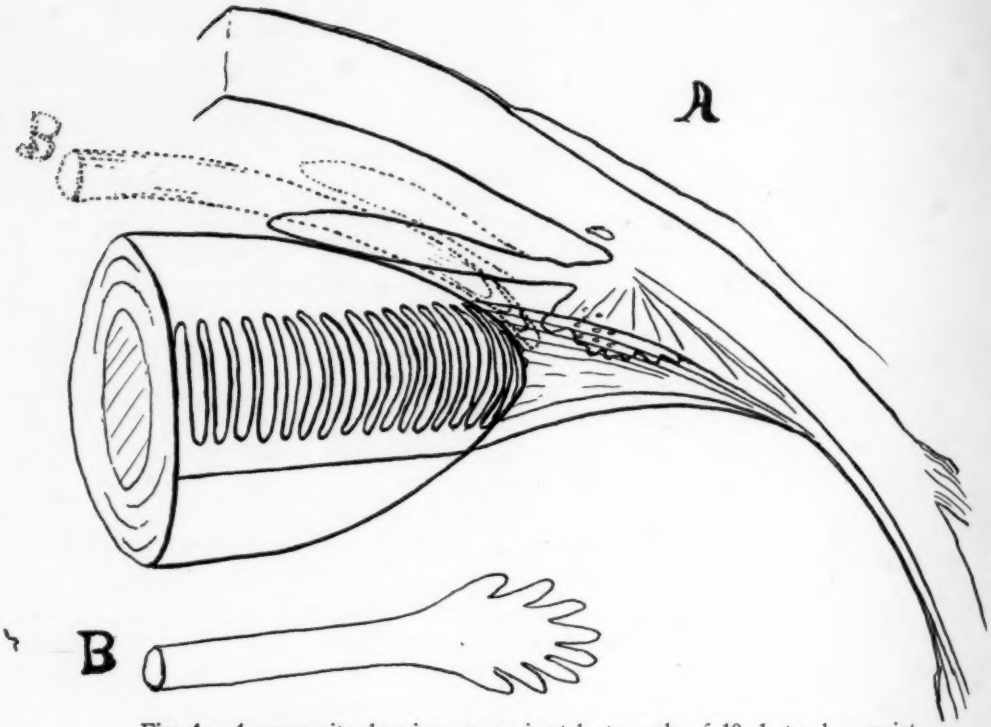


Fig. 4.—*A*, composite drawing, approximately to scale of 10:1, to show point of application of zonulatome; *B*, the anterior caudal position of the zonule (after Helmholtz).

as described by O'Brien;[3] while the ciliary injection may be made in the upper instead of the lower quadrant, so that the superior rectus may be weakened the most.

When closure is made with these sutures, the feeling of security obtained repays fully for the time and labor spent. To prevent tying too tightly, and to manipulate gently, I strongly advise the use of cilia

3. O'Brien, C. S.: Akinesis During Cataract Extraction, Arch. Ophth. **1**: 447 (April) 1929.

forceps, using the method of wrapping one thread around the tip of the forceps before picking up the other thread.

One of the main hopes in perfecting this painstaking suture is to use it in the intracapsular operation; I have used three scleral sutures in the Knapp operation and also in the Barraquer suction operation. This may be more than necessary. In fact, I think that one good scleral suture fortified by a conjunctival suture on each side, placed after extraction only if necessary, may be sufficient in all cases except when loss of vitreous is to be anticipated or definitely feared.

Another considerable difficulty with the intracapsular operation by either method is the tendency for the capsule to tear because of the occasional toughness of the zonular ligaments in perhaps 10 per cent of the cases, so that more pressure or tension is required than it is advantageous to use. To combat this difficulty, I have devised an instrument (fig. 4*B*) with a spatula tip curved to fit the lens and to reach almost to its equator. Fine, blunt teeth, about three to the millimeter, are arranged on its curved tip to engage the most anterior and strongest zonular folds and rupture them with a lateral motion at the anterior caudal border of the lens. After a slight weakening at this part, the lens is made to tumble with relatively little force. The ratio of about three blunt teeth to the millimeter is selected to correspond to the estimated frequence of anterior radial folds of the zonular ligaments or membrane. These folds,[4] often called fibers, have a double mechanical advantage due to their axis. A lateral sawlike action on a few of these fibers at a time will readily rupture them. It may be necessary to lift the corneal flap and perhaps to press the lens back with a spatula in order to bring the zonulatome into position. All this will be possible when a strong zonule is encountered, while with a weaker zonule the instrument is not necessary.

1. While three exactly appositional scleral sutures may be and have been used with gratifying success, yet one of these sutures with a conjunctival stitch on each side will prevent many accidents.

2. The loss of time should equal the time it takes the various injections to become sufficiently effective, so that little time is lost in the modern operation.

3. A good appositional scleral suture, with two accessory conjunctival sutures if necessary, will, in case vitreous is lost in moderate amount, still permit of average final results.

---

4. Ida Mann considers these "folds" to be really fibers by development and not membranous folds. Yet Helmholtz stated that the zonule was originally called the "godronne" (ionic eggmolding) because of its appearance when the space between these "fibers" and the hyaloid membrane, called the canal of Petit, was inflated.

LATE POSTOPERATIVE SEPARATION OF THE CHOROID*

GEORGE S. DERBY, M.D.
BOSTON

Postoperative separation of the choroid was thought to be rare until Fuchs, in 1900, showed that it was a comparatively common occurrence. In the first series of cases that he published one case appears in which the separation did not take place until four months after operation. Fuchs rightly advanced the view that such an observation belonged among the great rarities of ophthalmology. Time has proved the correctness of his judgment, since even up to the present day few of these cases appear in the literature. For that reason the following case seems worthy of record.

REPORT OF CASE

W. L. R., a teacher, aged 55, a patient of Dr. Alexander Quackenboss, developed chronic simple glaucoma in 1928, and was referred to me for operation. Central vision was normal in each eye. Both fields showed a nasal step connecting with an arcuate scotoma from the blind spot. There was early cupping of each disk. The tension without the application of pilocarpine nitrate measured 36 mm. (old Schiötz tonometer). After the administration of pilocarpine, the tension dropped to 18 mm. in the right eye and to 21 mm. in the left eye.

On Jan. 8, 1929, the left eye was trephined, a 2 mm. blade being used. The operation was without incident, and a good bleb was obtained; since that time the tension has averaged about 10 mm. Meanwhile, the tension of the right eye rose to 30 mm. in spite of the faithful use of pilocarpine, and on April 23, it was trephined. The result was good, the tension being reduced to between 12 and 15 mm. (old Schiötz). The anterior chamber became reestablished a short time after the operation in each eye.

On Jan. 3, 1930, the patient reappeared, with the complaint that for two or three weeks he had been seeing poorly with his right eye. Central vision was then 6/9, the field was markedly contracted, especially laterally, the anterior chamber was flat, and there was a large separation of the choroid on each side which extended well back of the equator and a smaller one below. The tension was 6 mm. There was no conjunctival bleb. Although a fistula through the conjunctival flap was looked for carefully, fluorescein and the corneal microscope being used, none could be demonstrated either by myself or by Dr. J. H. Waite, who saw the patient with me. The conjunctiva over the trephine opening was fairly thick and uniform. In the line of the conjunctival incision there was one small transparent blister. Although no leak could be demonstrated and there had been no history of injury or violent exertion, it seemed obvious that a small leak had developed in the eye, that the tension had suddenly been lowered, and that the choroidal separa-

* Submitted for publication, June 10, 1930.

* Read at a Meeting of the American Ophthalmological Society, Hot Springs, Va., June 2, 1930.

tion followed. No change took place in this eye within six weeks, and I decided to dissect up the conjunctiva at the site of the original incision some millimeters above the limbus, and to close it again as tightly as possible. If this did not succeed, I planned to dissect up the whole flap and put fresh conjunctiva over the trephine opening. The first procedure was set for February 20; the patient, whom I had not seen for several days previously, was on the operating table, when I found that the eye was decidedly firmer, the anterior chamber was slightly reestablished, and the choroidal separation appeared somewhat smaller. The tension was 33 mm. Naturally, there was no operation. One week later the anterior chamber was considerably deeper, the choroidal separation had entirely disappeared, the field had regained its previous outlines, and the tension was 27 mm. I gave him 2 per cent pilocarpine, which reduced the tension within a week to 16 mm., and it still remains satisfactory.

To sum up, this patient had a trephine operation on each eye without incident. Eight months afterward the tension suddenly became reduced in the right eye, the anterior chamber was lost, and an extensive choroidal separation developed. Six weeks later the tension was spontaneously reestablished, and the separation disappeared. It seems reasonable to suppose that for some unknown cause a minute fistula developed in the conjunctival flap, probably in the line of the conjunctival incision, and either it closed spontaneously or for some reason the trephine opening itself became largely occluded. It may be said that the small blister that was observed in the line of the conjunctival incision could no longer be seen when the tension became reestablished.

COMMENT

The subject of choroidal separation has been so thoroughly discussed in the literature that to go into it again on this occasion would be mere repetition. I shall merely refer to the paper read before this Society by Verhoeff and Waite [1] in 1925, who reported a case of spontaneous separation of the choroid. At the end of their paper is a list of many of the articles that had appeared in the literature up to that time. In 1911, Meller [2] established that postoperative separation is always associated with sudden lowering of tension in the eye through leakage from the wound, and that nearly all of the cases occur within a short time after operation. Fuchs [3] found 4.7 per cent of separation after cataract extraction and 10 per cent after iridectomy for glaucoma. Meller found

1. Verhoeff and Waite: Separation of the Choroid, with the Report of a Spontaneous Case, Tr. Am. Ophth. Soc., 1925, p. 120.

2. Meller: Ueber post-operative und spontane Chorioidealabhebung, Arch. f. Ophth. **80**:170, 1912.

3. Fuchs: Ablösung der Aderhaut nach Operation, Arch. f. Ophth. **51**:199, 1900; Ablösung der Aderhaut nach Operation, ibid. **53**:375, 1902; Ueber seröse Aderhautabhebung, ibid. **104**:247, 1921.

22 per cent after Lagrange sclerectomy and none following cyclodialysis. Hagen,[4] after using a special method of transillumination to detect the smaller separations not ophthalmoscopically visible, expressed the belief that he could demonstrate a separation in 22 per cent after cataract extraction and in 76 per cent after the trephine operation.

Postoperative choroidal separation ordinarily occurs within eight days after operation, and disappears within a month. Rarely does it persist longer, though several cases have been reported with a duration up to six months (Axenfeld, Maschler [5]), and in at least two instances the eye has degenerated and has had to be removed (Meller, Devereux Marshall [6]). Therefore, when a postoperative separation persists unduly long, it would seem advisable to pull a conjunctival flap down over the wound.

Occasionally, the closing of the wound is followed by an attack of acute glaucoma, as in two of Fuchs' cases, and in the case reported in this paper the tension rose above normal, to be reduced later by the application of pilocarpine, whether permanently or not cannot yet be told.

In regard to cases of late postoperative separation of the choroid which can be found in the literature, there is not much to say. Fuchs mentioned one case that occurred four months after cataract extraction, and remarked about its rarity. Devereux Marshall [6] reported the case of a patient who was operated on successfully for cataract. Six months after the operation the anterior chamber disappeared, and the patient began to see poorly. The eye became soft and irritable and finally had to be removed. Sections showed a choroidal separation in all quadrants. Meller [2] observed a case which occurred more than three years after extraction following trauma to the head. The tension was minus 2, there was almost no anterior chamber, and a well marked choroidal separation was present on both sides of the eye. The eye became inflamed and painful and was removed. The wound had opened, there was a slight prolapse of the iris, and the wound and anterior chamber were lined with epithelium.

Although no exhaustive search of the literature is claimed, a fairly careful examination of the articles written during the past twenty-five years has yielded only these few cases. One must therefore agree with Fuchs that the condition is one of great rarity.

---

4. Hagen: Die seröse post-operative Chorioidealablösung und ihre Pathogenese, Klin. Monatsbl. f. Augenh. **66**:161, 1921.

5. Maschler: Ein Fall von langdauernder Aderhautablösung, Klin. Monatsbl. f. Augenh. **64**:549, 1920.

6. Marshall, Devereux: Detachment of the Choroid, Tr. Ophth. Soc. U. Kingdom **16**:98, 1896.

IMBALANCE OF THE VERTICALLY ACTING EXTRA-OCULAR MUSCLES*

HENRY CARROLL SMITH, M.D.
NASHVILLE, TENN.

The literature dealing with the subject of extra-ocular muscle imbalance would indicate that deviations from the normal balance caused by abnormalities of the laterally acting muscles are more generally understood, both as to diagnosis and treatment, than are those caused by abnormalities of the vertically acting muscles. A comparatively small number of papers and reports on hyperphoria and hypertropia are available; perhaps the chief impression acquired from a study of these comes from the uncertainty with which the authors, with but few exceptions, treat their subject. In what follows will be found the facts collected and the conclusions formed from an examination of the subject of the vertical muscle deviations by means of literary research, supplemented by the observation of a group of patients treated for vertical strabismus at the Herman Knapp Memorial Eye Hospital.

Pertinent to an understanding of the anomalies of the vertically acting extra-ocular muscles is the realization that these muscles do not in any instance act singly. They accomplish rotation of the eyeball in every direction by the associated action of groups which, for monocular movements, are designated synergists and, for binocular movements, yoke muscles or associates. Opposing the synergists and associates are groups of antagonists. In the consideration of squint due to spasm of any muscle, it will be apparent how essential is a knowledge of the workings of the ocular muscles in divisions of antagonists as well as of associates.

Peter [1] asserted that the deviation of the globe in the presence of paralysis of one vertically acting muscle is not apparent on ordinary inspection because of the fact that for each cardinal vertical direction in which the eyeball moves there are two muscles responsible. The superior rectus and the inferior oblique are the elevators, the inferior rectus and the superior oblique the depressors, of the globe. It is well to consider the function of each of these muscles as of two parts: (*a*) the primary, or physiologic, action of the muscle, and (*b*) the action of greatest vertical pull. The superior rectus primarily draws

* Submitted for publication, June 30, 1930.

* Thesis submitted to the Faculty of Ophthalmology of the University of Pennsylvania in partial fulfilment of the requirements for the degree of Master of Medical Sciences for graduate work in ophthalmology.

1. Peter, Luther C.: The Extra-Ocular Muscles, Philadelphia, Lea & Febiger, 1927, p. 232.

the eyeball upward and inward. It is not in this direction, however, that the muscle has its greatest elevating power. Since it is attached to the globe in such a manner that its long axis forms an angle of approximately 23 degrees with the anteroposterior axis of the eyeball, its vertical pull is greatest when the globe is rotated outward 23 degrees, or to such an extent that the two axes coincide. The same conditions are true for the inferior rectus. The oblique muscles, arising medially and anteriorly, and being attached posterior to the equator of the globe at angles of approximately 54 degress with its axis, must produce their maximum vertical pull when the eye is rotated inward so that the long axes of the muscles coincide with the anteroposterior diameter of the globe. Their primary action from the position of eyes front consists in elevating or depressing the globe and rotating it outward.

Duane called the muscles that act most freely vertically when the eyes are rotated to the right the right-hand elevators and depressors, and those which exhibit their strongest vertical pull when the eyes are rotated to the left the left-hand elevators and depressors. These yoke muscles comprise four pairs. They are: the superior rectus of each eye with the inferior oblique of its fellow, and the inferior rectus of each eye with the superior oblique of its fellow.

While the work of the synergists insures against extreme deviation of the affected eye, it appears that the conjugate action of the muscles of the two eyes makes for deviation of the unaffected one when a vertically acting muscle is paralyzed. The latter condition is called secondary deviation, and this it is that obtains in many cases of spasm of the extra-ocular muscles. The yoke muscles normally receiving equal stimuli from the nerve centers, secondary deviation is produced when the increased stimulus given to a paralyzed muscle in the effort to make it move the eyeball into its field is added to the usual stimulus required to induce its associate to act in that field. The result is an overaction of the associate, and the sound eye exhibits a deviation in excess of that shown by the affected eye. In the presence of paralysis of a given muscle in one eye, fixation with this eye causes overaction of the associate to that muscle in the fellow eye which amounts truly to spasm. The finding of this condition may lead to a wrong diagnosis because the squint appears in the actually sound eye.

In a chapter, headed "Anomalies of the Extra-Ocular Muscles: Symptoms and Diagnosis," from an unpublished volume by the late Dr. Alexander Duane [2] the author made this statement: "Paralysis of a muscle in one eye is invariably accompanied by a spasm of its associate in the fellow eye. This spasm becomes manifest as soon as fixation is

2. Reviewed through the courtesy of Dr. James W. White.

shifted from the sound to the affected eye." Duane also stressed the equivalence of the effect of paralysis of one muscle and that of spasm of its associate in saying that, in so far as the relative movements of the eyes, and the deviation and symptoms produced are concerned, the effect of a paralysis of any single muscle is the same as that of a spasm of its associate.

ETIOLOGY

Little discussion of the etiology of paralysis and spasm of the extra-ocular muscles will be given here. Trauma, local and general disease, and innervational disturbances of a variety of origins may all be blamed. The conditions may be congenital or acquired. Primary spasm of an individual muscle is a recognized entity, the term implying the existence of an overaction of the muscle without the predisposing factor of an underaction, or paralysis, of its yoke-fellow. Brownell [3] reported a case of primary spasm of the superior oblique muscle which appeared in a patient suffering from acute frontal sinusitis following injury to the supra-orbital region of that side.

SYMPTOMS

The subjective symptoms and those elicited by objective examination are of varying importance. A patient afflicted with squint may seek relief from a number of bodily discomforts entailed by the squint, or he may be free from these and desire correction of the disorder solely for cosmetic reasons. In his prize essay delivered at the International Medical Congress in London in 1881, Stevens [4] made the assertion that difficulties of adjustments of the eyes are a source of nervous troubles and, more frequently than other conditions, constitute a neuropathic tendency. He is also responsible for the statement that a predisposition to specific infection of the chest is established by head-tilting and shoulder-stooping in patients who have disturbances of the vertical ocular muscle balance. In the same paper in which he pointed out this danger, Stevens, for the first time in the history of ophthalmology, mentioned the distinction between hyperphoria and vertical strabismus.

The symptoms which arise from hyperphoria often give more annoyance to the patient than those produced by hypertropia. In the former, continued effort at fusion of the images of the two eyes is a great wearing influence on the nervous mechanism of the patient, and is the source of general physical ailments. In the latter condition, diplopia, which is the principal distressing symptom, is often overcome

3. Brownell, M. E.: Primary Spasm of the Superior Oblique Muscle, Am. J. Ophth. **11**:41, 1928.

4. Stevens, George T.: Historical Notes of Strabismus and Other Anomalies of the Eye Muscles, Ann. Ophth., April, 1889, vol. 1, no. 2.

in a comparatively short time, the patient learning either to suppress the visual image of one eye, or to tilt the head in such a manner as to bring the images together. Occasionally, the patient discovers that by tilting the head so that the images are more widely separated he is enabled to suppress, or at least to disregard, the false image. A comparison of the amplitude of the vertical duction power with the amplitude of lateral duction power will demonstrate why the effort at fusion and the symptoms caused by it are so much more extreme in the presence of hyperphoria than they are in exophoria and esophoria.

Diplopia, false projection, apparent movement of objects, confused vision, headaches and vertigo are among the symptoms of which the patient may complain. The objective symptoms of real vertical strabismus are not easily overlooked. They are, chiefly, deviation of the visual axes from parallelism, and turning of the face and tilting of the head.

THE TESTS

Means employed in discovery of the muscle affected, whether from paralysis or from spasm, are principally those tests which compose a study of the diplopia existing, and of the direction and amount of deviation of the visual axes. The methods include, therefore, examination of the fields of monocular fixation, binocular excursion tests, screen deviation and screen comitance tests and, when diplopia can be elicited, mapping of the fields of double vision. Other methods, which are of minor importance in the obvious cases, but which have some value in the obscure ones, are the tests of projection and of torsion, and the observance of the direction of face-turning and head-tilting.

To determine whether the condition present is paralysis or spasm, examination of the fields of monocular fixation is of value. The test should show subnormal excursion of the eye into the field of action of a weakened muscle, and increased power of rotation in the direction of action of a spasmodic muscle. In the majority of instances, spasm is secondary to paralysis of a yoke muscle, and this condition should be carefully searched for. Primary spasm, however, is not to be considered entirely improbable.

The projection test also serves to differentiate paralysis from spasm. The increased stimulus expended on a paralyzed muscle in bringing the eye to fix on an object is so registered mentally that the patient believes the object displaced in space beyond its actual position. When asked to touch or point to the object, he will therefore reach farther than necessary to find it. In spasm, on the other hand, the diminished stimulus required to bring the eye to fix on an object creates the impression in the patient that the object is nearer to him that it actually is, and he designates a point between himself and the object as being its position.

The measurement of vertical deviation by the use of prisms has been employed in the examination in the cases to be discussed in this paper. Prisms are placed base down before the higher eye, or base up before the lower one, while the eyes are alternately screened as the patient fixes on an object held successively in the cardinal directions of rotation. The strength of the prism, vertically placed before the affected eye, that will stop the movement of the unaffected eye under cover represents the degree of primary deviation present. The strength of the prism that, placed before the sound eye, will stop the movement of the unsound eye under cover represents the amount of secondary deviation. The latter is usually greater than the former in paralytic squint. The amount of deviation is expressed in prism degrees or centrads, which can, if desired, be converted into degrees of arc. When the test is made in each of the four cardinal directions of associated vertical movement of the eyes, that direction in which the amount of deviation is found to be greatest indicates the field of action of the offending muscle. This procedure is of especial advantage with those patients who have learned to suppress the image seen with one eye, so that the distortion tests, such as the Maddox rod test, are made impossible.

Whether the calculation is of primary or of secondary deviation as regards the placing of prisms before one eye or the other is of little importance. The chief consideration lies in the observance of which is the higher eye and in what field the deviation is greatest. The reason for this is found when the conjugate arrangement of the muscles into right and left hand elevators and depressors is recalled. Right hypertropia, greatest when the eyes are directed upward and to the right, would mean a paralysis, more or less marked, of the left inferior oblique muscle. The same condition, increasing in eyes up and left, would indicate paralysis of the left superior rectus. In either case, spasm of the associate to the paralyzed muscle would obtain, and, if no paralysis were present, primary spasm of the associates would be suspected. The latter condition is so rarely seen that for practical purposes it is not considered. The downward direction in which hypertropia is greatest represents the field of maximum vertical pull of the depressor at fault. For example, left hypertropia, increased when the eyes are rotated downward and to the left, would be caused by either paralysis of the left inferior rectus or spasm of the right superior oblique.

There is a condition, described by Stevens as anatropia or anaphoria, and sometimes called double hypertropia or hyperphoria, in which bilateral weakness of an elevator with spasm of the conjugate muscles exists. Thus, with paralysis of the superior rectus of both eyes, when the one eye fixes, the other, through the overaction of its inferior oblique,

performs secondary deviation upward and inward. Double inferior oblique paralysis with superior rectus spasm may likewise exist. Duane [5] reported a case of bilateral paralysis of the superior oblique. Double hyperphoria and hypertropia are not particularly rare. They are, apparently, often overlooked. The anomaly may be discovered after operation for correction of the upshoot in one eye, when that of the other eye becomes more evident. It is most often found after convergent or divergent squint has been corrected. The screen test shows each eye up under cover when the condition is present. Sometimes, however, the double deviation is not noticed until the predominating hypertropia, or hyperphoria, has been partially corrected by prisms. Then that of the other eye becomes manifest. The amount of weakness and of corresponding spasm is not often equal in the two eyes.

This anomaly has been divided by Bielschowsky [6] into two groups. The first is composed of those cases which show no deviation of the visual axes in the primary position of eyes front. The imbalance appears as a distinct upshoot of the right eye if the eyes are turned to the left, and of the left eye if they are rotated to the right. Placed in the second group are those cases which exhibit constant upshoot of one or the other eye. Bielschowsky called this condition, in which, regardless of the direction of the visual axes, parallelism is never attained, dissociate vertical squint. Contracture of the antagonists to the paretic muscle, as well as spasm of its associate, would enter into it.

Imbalance may be the result of paresis, when the deviation is less than that produced by complete paralysis. In either instance, the examination reveals a definite deviation which is always increased when the eyes are rotated into the field of maximum vertical pull of the affected muscle.

When contractures of the antagonists to paralyzed muscles occur, deviation is present in more than one vertical direction, and the difficulty of diagnosis is increased. The deviations in the fields of secondarily contracted antagonists rarely equal that present in the field of the primarily contracted muscle; if, however, these degrees of spasm approach equality, deviation will become comitant, or nearly so.

In the diplopia field, the direction in which the vertical separation of the true and false images is most evident should correspond with that in which the objective measurement of deviation is greatest. It is of interest to observe whether the diplopia is crossed or homonymous. This point, however, is not of much aid in diagnosis, as exophoria or

5. Duane, Alexander: Isolated Paralyses of the Ocular Muscles, Arch. Ophth. 1897, vol. 26, no. 3.

6. Bielschowsky, A.: Die einseitigen und gegensinnigen (dissocierten) Vertikalbewegungen der Augen, XIII Concilium Ophthalmologicum, Amsterdam-Den Haag, September, 1929.

esophoria already present may overcome the lateral diplopia so that there is either none whatever in evidence, or the diplopia of the original condition, less in amount, remains. Diplopia may also vary with the upward or downward direction of the visual axes, there being greater tendency to convergence, and with it homonymous diplopia, when the eyes are rotated downward. Theoretically, a crossed diplopia would be expected in paralysis of the recti, and homonymous diplopia in paralysis of the oblique muscles. The false image is to be found toward the side of physiologic action of the weakened muscle.

The tilting of the false image is in the direction of normal torsional effect of the muscle. Therefore, in paralysis of the superior rectus or superior oblique the false image should be tilted inward, and in paralysis of the inferior rectus and inferior oblique it should be tilted outward. The vertical separation of the images remains the factor of chief importance in the study of diplopia.

Head-turning and shoulder-tipping are more or less constantly present in vertical strabismus. In the attempt to overcome diplopia, the patients learn to turn and tilt the head so that corresponding retinal points receive the stimuli from objects fixed, and binocular single vision is restored. White [7] stated that head turning and tilting, though usually performed in the interest of binocular single vision, occurs in the presence of amblyopia and monocular blindness. He believed, therefore, that the act is based on some neuromuscular impulse. The head-turning takes place in the direction of maximum vertical pull of the muscle paralyzed. He held that the turning of the head is in the direction of the false image, and that it will be governed by the type of lateral diplopia present. If there is no lateral diplopia, the head will tilt to the right or left according as the vertical separation of the images is more marked when the head is turned to one or the other side. Just as superimposed exophoria or esophoria may mask the symptoms of a vertical muscle disturbance when the diplopia chart is consulted, a like situation may render obscure the meaning of the head-tilting. Peter [8] described, in addition to head-turning, shoulder-tipping, which he says seems to represent an effort to overcome the leaning of the false image and is therefore connected with torsional effects of muscle palsies. The tipping, corresponding with the leaning of the image, would follow, then, the direction of normal torsional action of the muscle blamed.

OBSERVATION OF CASES

Twenty patients who have been treated for vertical squint at the Herman Knapp Memorial Eye Hospital within the past six years were

7. White, James W.: Head Tilting and Turning of Ocular Origin, Am. J. Surg. **4**:77 (Jan.) 1928.

8. Peter (footnote 1, p. 250).

examined. The data obtained in thirteen of the cases are deemed of sufficient importance to record:

Nine of the patients had congenital paralysis of the superior rectus with inferior oblique spasm. Of four cases in which the condition was attributed to trauma, two were from head injury and two were due to direct injury. One of the latter was caused by a blow on the eye, with resulting paralysis of the superior oblique; the other followed radical operation for drainage of the frontal sinus, with ensuing paralysis of the inferior oblique and paresis of the superior oblique. Bielschowsky [9] described a similar disturbance of the inferior oblique after operation on the frontal sinus. He ascribed it to a lesion of the fascial band attached to the trochlea.

In six cases esotropia was present, and in five of these operations for correction of the lateral imbalance had preceded measures for correcting the vertical deviation.

Eleven patients had been operated on for vertical strabismus. The operation performed was, in all the cases except one, tenotomy of the inferior oblique. For paresis of the superior oblique, tenotomy of its conjugate inferior rectus was employed.

Of ten patients who had undergone tenotomy of the inferior oblique, three showed total correction and seven residual vertical imbalance. Of these last, four had double hypertropia. In one of them, double tenotomy of the inferior oblique had corrected the imbalance in the original fields, but there remained some deviation in the fields of contracted antagonists. The other three had received only one operation, which is not sufficient to abolish the deviation in all fields. The three cases remaining of the group of seven showed residual imbalance in the field of the inferior oblique, as well as in the fields of contracted antagonists.

The patient who received tenotomy of the inferior rectus for superior oblique paralysis was examined two days after operation. At this time, there was considerable over-correction, and the patient complained more of diplopia than before the operation.

Head-tilting was present in six patients. In four, it took the direction of primary action of the muscle involved, and in two the tilting was to the opposite side. One patient exhibited head-tilting five years after vertical deviation had been corrected by tenotomy of an overacting inferior oblique. In three of the others the condition had been completely abolished, in two it was constantly present in less degree and in one it appeared occasionally.

Hyperopic astigmatism was the error of refraction in all but two cases. One of these showed low myopic astigmatism; the other showed mixed astigmatism.

9. Bielschowsky, A.: Beweglichkeitstörungen des Augen, diagnostiche und therapeutische Irrtumes, Leipzig, Georg Thieme, 1922, p. 33.

A report of three cases of double hyperphoria and hypertropia will serve to illustrate most of the points heretofore discussed:

REPORT OF CASES

CASE 1.—M. C., aged 15, had undergone tenotomy of the inferior oblique muscles, right and left, for paresis of the superior recti. The head had tilted to the right shoulder. Three years after operation, the following observations were made: Vision in the right eye, with $-1.00+2.50$ axis 60, was 20/50; in the left eye, with -1.00 axis 180, vision was 20/30. The near point of convergence was at 7.5 cm. The fields of mononuclear fixation were normal. In the comitance test, no appreciable upshoot of either eye in associated upward movements was seen. The screen deviation test revealed: in the primary position, esophoria 12 degrees and right hyperphoria 1 degree; eyes up and right, orthophoria, and eyes up and left, right hyperphoria 8 degrees; eyes down and right, left hyperphoria 3 degrees, and eyes down and left, right hyperphoria 8 degrees. The diplopia field appeared as follows (R represents image of right eye and L, image of left eye):

	R L	R L	L R	
Right	R L	R L	R L	Left
	R L	R L	L R	

Binocular single vision and fusion were present. There was slight head-tilting toward the right shoulder. Spontaneous diplopia in the lower lateral fields did not annoy the patient.

CASE 2.—F. H., aged 3, had undergone tenotomy of the internal recti, right and left, for alternating convergent strabismus. This was followed in eighteen months by tenotomy of the left inferior oblique for left hypertropia. Four months after the latter procedure, examination yielded the following results: The comitance test showed: in the primary position, right hypertropia; eyes up and right, excursion limited in the right eye and overshooting in the left eye; eyes up and left, excursion limited in the left eye and overshooting in the right eye; eyes down and right, and eyes down and left, excursion normal. There was slight head-tilting toward the right shoulder. No measurements could be made because of the age and mentality of the patient. The left eye was used for fixation. Increased rotation of the left eye in associated movements up and right was more definite than was that of the right eye in eyes up and left.

CASE 3.—In F. D., aged 5, double tenotomy of the internal recti for convergent strabismus had been followed after one year by double advancement of the external recti. When the lateral deviation was corrected, there was a left hypertropia of 12 degrees in the primary position, increasing to 30 degrees in associated movements upward and to the right. For this, tenectomy of the left inferior oblique was performed. Two weeks after the last operation, the patient exhibited double hypertropia of 12 degrees in the primary position. The left eye was now preferred for fixing, so that the deviation of the right became more obvious.

COMMENT

In case 1, the operation had accomplished almost total correction of the deviation due to overaction of the left inferior oblique muscle; the result with regard to spasm of the right inferior oblique was not so good. Persisting contracture of the antagonists to the two paretic muscles was producing the imbalance in the lower quadrants. The diplopia chart checked with the results of the screen deviation test. Crossed diplopia in the left upper quadrant could be expected in paresis of the left superior rectus muscle. The question of tenotomizing the overacting inferior recti would then arise.

Cases 2 and 3 demonstrate instances of failure on the part of the examiner to discover double verticle deviation until after an attempt to abolish monocular deviation had been made. In each case, the primarily upshooting eye took up fixation after tenotomy of its spasmodic inferior oblique, and the other eye became the one deviating. No further treatment has been given to these two patients. For each of them, it would seem reasonable to attempt by surgical measures to restore parallelism of the visual axes, and by use of the stereoscope, or the amblyoscope, to establish fusion.

In double hyperphoria, when caused by equal paresis of the superior recti, each inferior oblique may be tenotomized. Case 1 illustrates a fairly good result from this; however, the adoption of another procedure here might have abolished the imbalance which remains in the left upper quadrant. Supposing the superior recti to be unequally paretic, the method would consist in tenotomizing the inferior oblique conjugate to the more paretic muscle, and in performing advancement of the less paretic muscle. By this means, parallelism of the visual axes would be obtained on an elevated plane for one direction of associated upward movement and on a lowered plane in the contralateral upper field. Cases 2 and 3, in both of which tenotomy of the more spasmodic inferior oblique was performed, might now be corrected by advancement of the less weak superior rectus.

TREATMENT

It is not generally accepted that correction of a lateral deviation should precede operation for abolishing a vertical one. A definite rule regarding this problem cannot be made. Stevens [10] believed that the vertical imbalance should be attacked first. In a paper read before the American Medical Association in 1891, he offered the opinion that tenotomy of the internal rectus (the operation then employed for correcting esotropia) would, in the presence of vertical muscle imbalance, only serve to superimpose divergence on the vertical disturbance exist-

10. Stevens, George T.: Anomalies of the Ocular Muscles, Arch. Ophth., 1891, vol. 20, no. 3.

ing. Peter [11] advised correction of lateral deviations first, stating that by this method vertical imbalance may be brought within the correcting power of prisms. It would seem a good procedure to study the effect produced on each by prism correction of the other, and to apply surgical measures first in the treatment of the one that is the less favorably affected.

For the lesser degrees of imbalance which persist after the original deviation has been corrected, some surgeons advocate tenotomy of the spasmodic muscles and advancement, in turn, of their antagonists. Thus, a series of operations might be performed in the effort to render the visual axes parallel in all directions of rotation.

Constantly changing muscle balance would suggest the presence of a nerve disorder, such as multiple sclerosis. Extra-ocular muscle palsies due to trauma, especially to head injuries, often disappear with the passing of time. Before employing surgical measures, it is therefore well to ascertain that the condition is stationary.

The mode of treatment of vertical muscle imbalance has proved ground for considerable controversy. Disregarding the prescribing of prisms, which is practiced for the correction of limited amounts of hyperphoria, the argument concerns itself with the relative therapeutic value of two procedures: the weakening of the overacting muscle, and the strengthening of the underacting one. The former can be most advantageously applied to the inferior oblique muscle, which does not lend itself easily to any operation except tenotomy or its substitutes. Recession of the recti is practiced. Strengthening by resection and advancement, or by the tucking operations, is most applicable to the recti; however, the procedures have been performed on the inferior oblique muscle.

Tenotomy of a too active inferior oblique muscle is designed to equalized the excursions of the two eyes into the field of its underacting yoke-fellow without affecting in any way the normal rotations in the remaining directions. Advancement of a weakened rectus has for its purpose, likewise, the equalization of rotations in its field. It seems plausible, however, as Duane [12] stated, to expect from the latter procedure a limiting of the excursion of the direct antagonist, and therefore an inequality of conjugate rotations in the direction of its pull. If paralysis is complete or nearly so, and spasm consequently extreme, both advancement of the paralytic muscle and tenotomy of the spasmodic one may be required for correcting the deviation. Whatever the procedure, the aim should be toward a leveling of the visual axes in the direction in which the disturbance has occurred.

---

11. Peter (footnote 1, p. 222).

12. Duane, Alexander: Tenotomy of Inferior Oblique: Technic of Operation, unpublished; reviewed through the courtesy of Dr. James W. White.

Tenotomy of the inferior oblique muscle was first described by Landolt in 1885. In 1906, Duane described it in an address before the British Medical Association, and, in 1915, Posey [13] read a paper on the subject before the American Ophthalmologic Society. Duane's [12] classification of the cases in which this operation is indicated is given:

1. Conditions simulating spasm of the inferior oblique; e.g., paralysis of the superior rectus, the patient fixing with the other eye; no true spasm.

2. True spasm of the inferior oblique secondary to paralysis of other muscles: (*a*) paralysis of the superior rectus, the patient fixing with the same eye; spasm of the inferior oblique of the other eye; (*b*) paralysis of the superior oblique, or some other elevator or depressor, with secondary spasm of the inferior oblique in the same eye; (*c*) paralysis of the abducens with secondary spasm of the inferior oblique in the same eye.

It is interesting to note that this procedure was not used in all of the cases reported in Duane's paper describing tenotomy of the inferior oblique muscle. One patient, in whom slight paresis of the superior rectus was accompanied by spasm of the inferior oblique of the other eye, was treated by tenotomy of the inferior rectus in the affected eye. The action of the paretic muscle was thereby increased, and the spasm of its associate abolished. In another, bearing the diagnosis of paresis of the inferior oblique, the symptoms were relieved by the incorporation of vertical prisms in a prescription for hyperopia.

Zentmayer [14] reported a case of paralysis of the inferior oblique which was corrected by tenotomy of the superior rectus of the other eye. He has performed tenotomy of the inferior rectus for paralysis of the superior oblique of the opposite eye three times.

Rowland [15] reported encouraging results in two cases from tenotomy of the inferior oblique. In both, there was a definite weakness of the associate superior rectus. Head-tilting was lessened by the treatment.

CONCLUSION

Altogether, the muscle disorders underlying vertical strabismus are well recognized. Treatment for this type of squint is not yet standardized. Results do not uniformly gratify expectations. They are, nevertheless, sufficiently on the side of benefit to justify the endeavor.

---

13. Posey, William Campbell: Tenotomy of the Inferior Oblique Muscle, New York State J. Med., May 1920.

14. Zentmayer, William: Paralysis of the Inferior Oblique Corrected by Tenotomy of the Superior Rectus of the Other Eye, Am. J. Ophth. **9**:617, 1926.

15. Rowland, W. D.: Tenotomy of the Inferior Oblique, J. Ophth., Otol. & Laryng. **32**: 120 (April) 1928.

Clinical Notes

SHORTENING AN EXTRA-OCULAR MUSCLE BY TUCKING

A New Instrument *

W. P. Speas, M.D., Hickory, N. C.

My purpose in this article is to describe the use of an instrument devised by me for muscle shortening in operations for the correction of squint. A discussion of the subject of squint as a whole and its correction would include fusion and binocular vision, which should be the ultimate aim in all cases in which there is sufficient vision to obtain this end.

While numerous methods of shortening and lengthening the extra-ocular muscles have been employed to produce parallelism, many surgeons prefer to use some method that does not destroy the continuity of the muscle fibers. With this fact in mind, I set about to devise an instrument that would be simple to use, occupy small space in the field of operation, be as accurate as possible in its results, produce the minimum amount of trauma to the muscle, preserve the blood supply to that portion of muscle included in the tuck, and protect the sclera and eyeball proper from possible injury.

Before describing this instrument and operation, it seems fit to review briefly what others have done in this field up to the present. In 1905, Todd [1] described many of the muscle shortening operations that had been done prior to that time, and I take the liberty to quote him often in this article. He quotes Knapp [2] as giving credit to J. F. Noyes [3] for the first description of shortening an extra-ocular muscle by folding. In his operation, however, the tendon was cut, so that his procedure does not properly belong in the catalog of tucking operations.

In 1885, de Wecker [4] described an operation which includes opening the conjunctiva over the tendon, undermining the conjunctiva around the cornea to the vertical meridian and opening Tenon's capsule, so as to pass a strabismus hook beneath the tendon. A suture is inserted, one end into the episcleral tissue above the cornea and the other into the under surface of the muscle and out through the conjunctiva. This suture is tied, and a corresponding suture is inserted below.

* Submitted for publication, July 11, 1930.

1. Todd, Frank C.: An Exact and Secure Tucking Operation for Advancing an Ocular Muscle, J. A. M. A. **44**:11 (Jan. 7) 1905.

2. Knapp, H., in Norris and Oliver: System of Diseases of the Eye, Philadelphia, J. B. Lippincott Company, 1898, vol. 3, p. 874.

3. Noyes, J. F.: A New Method for Operating for Strabismus, Tr. Am. Ophth. Soc. **10**:273, 1874.

4. De Wecker, L.: La combination de la tenotomie avec l'avancement capsulaire, Ann. d'ocul. **93**:72, 1885; Les opérations modernes du strabisme, Arch. d'opht. **13**:1, 1893.

In 1886, Knapp [5] described an operation as a modification and improvement on that of de Wecker. The modification consisted in the use of two additional sutures.

In 1892, Lagleyze [6] of Buenos Ayres described a folding operation in which the muscle is folded on the tendon. A piece of conjunctiva is excised over the tendon, a hook passed under the tendon and another under the muscle. One needle of a doubly armed suture is carried from within and entered through the muscle near the posterior hook 1 mm. from the upper border; the other needle is carried through near the lower border and brought forward in the same way. The needles are then carried beneath the conjunctiva almost to the cornea into the episcleral tissue and tied, causing the muscle to fold on the tendon.

In 1893, Savage [7] published the description of his operation. The conjunctiva and Tenon's capsule are opened near the lower border of the muscle. Two strabismus hooks are introduced, the one pushed forward and the other backward toward the belly of the muscle. One needle of a doubly armed suture is inserted into the scleral aspect of the tendon near its attachment and just below the upper border. The other needle is inserted into the muscle further back, and brought out through the capsule and conjunctiva. This needle is then carried back through the conjunctiva, capsule and muscle directly under the point of emergence and brought forward along under the muscle coming out through the tendon at a point just below the point pierced by the first needle. The sclera or episcleral tissues is not included. The suture is tied over the Price suture plate to prevent cutting.

In 1895, Valk [8] described his operation which is somewhat similar to that of Savage, though he was the first to use an absorbable suture.

In 1899, Greene [9] described a tendon tucker and his method of tucking. After producing the tuck, he included the middle of the three layers in one tie with a catgut suture. He did not include the conjunctiva or episcleral tissue.

Colburn,[10] in 1902, described an operation which he stated was first described by him in 1888 at the session of the American Medical Association. A single suture was used, which was inserted through the tendon near its point of attachment, carried back along the upper border of the muscle, through the muscle, and back along the lower border and back out through the tendon below the point of entrance. The conjunctiva was closed with another suture.

---

5. Knapp, H.: Advancement of Tenon's Capsule in Strabismus, Tr. Am. Ophth. Soc. **4**:345, 1886.

6. Lagleyze: Traitement du strabisme par la raccourcissement des muscles droits, Arch. d'opht. **12**:668, 1892.

7. Savage, G. C.: Muscle Shortening vs. Muscle Advancement, Editorial, Ophth. Rec. **2**:359, 1893.

8. Valk, F.: Further Observations on Convergent Squint, Post-Graduate, N. Y. **10**:258, 1895.

9. Greene, D. M.: Correction of Divergent Strabismus by a New Method and New Instrument, Ophth. Rec. **8**:461, 1899.

10. Colburn, J. E.: Muscle-Tucking: A Report of Cases and Conclusions, Ophth. Rec. **11**:192, 1902.

In 1902, Todd [11] first described his method, and later, in 1904, demonstrated it on a large manikin before the Section on Ophthalmology of the American Medical Association.[1] His instrument is much like a small pair of dividers or draftman's compass, with the two prongs parallel to the general lines of the instrument. These cross each other in such a way that when the nut at the end is turned they produce a fold in the tendon. Chromatized catgut is recommended, and placed in the two layers midway between the prongs as follows: "Carry the needle of one suture under the upper border nearly to the middle of the tendon, bring it outward through the two layers and tie it; place another suture in the same manner, including nearly the lower half of the two layers of tendon and tie it." Two silk sutures, one above and the other below, are carried through the conjunctival flap, the tendon behind the catgut suture already placed, and episcleral tissue and conjunctiva above and below the cornea respectively, and tied loosely. The tucker is then removed. "The pressure on the eyeball exerted by the tendon tucker disturbs, for the time being, the exact position of the eyeball; it now having been removed, the two eyes may be compared and measured and the silk sutures tightened until the desired effect has been secured."

In 1904, Bruns [12] described an operation in which an instrument was used that was devised by Dr. C. F. Clark of Columbus, O., and modified by Bruns. The instrument provides for pulling the flattened tendon between two immovable hooks by a movable hook, producing a loop and a shortening of the tendon in proportion. When the desired loop has been produced, a needle is carried through the middle of the width of the muscle, between the instrument and the sclera. The needle carries a double silk suture through, and is removed by cutting off the needle. There are thus two sutures through the middle of the muscle and tendon, the one of which is tied above and the other below, all the fibers being included. A "guy suture" threaded in the perforated tip of the movable hook and brought through the loop as the instrument is withdrawn, is doubly armed. The upper and lower needles are carried forward above and below the center of the cornea, respectively, in such a way as to include the episcleral tissues and conjunctiva. The upper needle is carried back and passed (from without, inward) through the posterior lip of the conjunctival wound above its center and about one-eighth inch from its edge, carried along beneath the conjunctiva and made to emerge about one-quarter inch below the point of entrance. This is then tied to the one which was carried out below the cornea.

In 1908, Briggs [13] described a method devised by him, in which a ring of silver wire is used instead of sutures. A specially devised hook is used to draw a fold of the muscle up through the ring of wire and when a sufficient amount of shortening has been obtained, the wire ring

---

11. Todd, F. C.: A Secure Advancement Operation Performed with the Aid of a New Tendon Tucker, Ophth. Rec. **11**:73, 1902.

12. Bruns, H. D.: Method of Advancing Tendons of Recti Muscles, Ophth. Rec. **13**:267, 1904.

13. Briggs, H. H.: A New Method of Tendon Shortening: Presentation of Instruments, Tr. Am. Acad. Ophth., 1908, pp. 212-214.

is pressed tightly on the muscle and allowed to remain for from ten to fourteen days. By this time adhesion has taken place, and the ring is cut loose by means of a specially devised scissors cutting forceps.

In 1909,[14] and 1912,[15] Suffa described a set of instruments for muscle operations, including a myometer with a movable clamp, a tenometer for making tendon measurements, a graduated fixation forceps to gage the displacement of a tenotomized tendon, a graduated regulator to show the distance the tenotomized tendon is being displaced while being fixed with anchor suture, retraction hook to raise stripped tendon and elevate conjunctival flap, a plain tenotomy hook and angular scissors.

Suffa's operation consisted in a measured tucking of the longer muscle and a corresponding measured shortening of the opposing muscle. The muscle to be shortened is freed, and the clamp is fastened transversely across the muscle 1 mm. back from the tendonous attachment for each four prism degrees of error to be corrected. A doubly-armed no. 6 thread is laid across the muscle just behind the clamp. The needle attached to the upper end of the suture is then introduced beneath the muscle, including one-fourth the width of the muscle, and brought out just anterior to the cross thread, between it and the clamp, close to the clamp. The needle is then passed back over the cross suture and reinserted through the conjunctival surface and brought out through the scleral surface of the muscle. The needle attached to the lower end of the suture is similarly placed at the lower border of the muscle. Both are carried forward and made to pierce the tendonous attachment at a distance from the upper and lower edge corresponding to the points at which the needles pierced the muscle, i. e., one fourth of its width. The opposing muscle is tenotomized, allowed to recede an amount measured by the graduated fixation forceps and controlled by a suture which connects the tenotomized end and the stump.

Wick [16] described an operation that he does without the aid of any instrument made especially for the purpose. Procaine hydrochloride is injected deeply into the orbit. The muscle to be shortened is freely exposed and a strong catgut suture so placed as to make a loop at the upper and lower margins of the muscle, and the ends of the suture are brought forward beneath the tendon and out through its scleral attachment. The size of the section included in the tuck corresponds, of course, to the degree of squint. The section of muscle included in the tuck is crushed with some suitable instrument, such as a needle holder, for the purpose of making it thinner and promoting adhesion. Traction is then exerted on the sutures with counter traction on the tendon insertion. After the suture is tied, two small catgut sutures are placed, one above

14. Suffa, George A.: An Original and Absolutely Reliable Suture for Tucking or Shortening an Ocular Muscle, Arch. Ophth. **38**:254, 1909.

15. Suffa, George A.: Further Communication of my Ocular Muscle-Tucking or Shortening Operation, Arch. Ophth. **41**:245, 1912.

16. Wick, W.: Muscle Tucking in Squint Operation, Ztschr. f. Augenh. **53**: 203, 1924.

17. Woodruff, H. W.: Shortening of an Ocular Muscle by Tucking, J. Ophth., Otol. & Laryng. **4**:127, 1910.

and the other below, so as to include, near the edge, the two layers of the tuck, and also the muscle proximal to the tuck. This binds the tuck down flat along the side of the muscle instead of bringing it forward toward the cornea, as in the operations of Bruns and others.

In the operation of Woodruff,[17] the muscle to be shortened is exposed. While an assistant holds the conjunctival flap out of the way, a needle threaded with oo formalized catgut is passed from below upward as far back from the tendon insertion as possible. This is tied after the manner of Worth, including muscle and capsule only. The needle, which is now under the muscle, is then passed through the tendon at its insertion close to the sclera, from underneath out. A similar suture is passed through the upper border of the muscle, tendon and capsule. When these sutures are tied, a fold is produced in the tendon and capsule at its insertion in the sclera.

Bishop,[18] in 1919, described the use of his tucker. It consists of two fixed T-shaped cross-bars, with a movable hook which draws a section of the muscle up between the cross-bars. The instrument is held perpendicular to the muscle, with the cross-bars forming its base squarely at right angles to the edge of the muscle, the hook being under it. To form the tuck the hook, carrying on it the muscle, is raised by means of the thumbscrew, thus raising a loop of muscle between the two standards. When sufficient shortening has been obtained, a oo twenty day catgut suture is passed through the two layers of muscle as near to the base as possible, above the standard, in the angle formed by the upright of each standard with its cross-bar base. A similar suture is inserted below the standard. The width of the standard separates the two sutures, and incidentally protects the blood supply of the loop.

In 1928, Harrison[19] described his instrument as consisting of two principal parts: The first part is the equivalent of a spring forceps, the jaws of which may be approximated by means of a nut and threaded bar. The second part consists of a hook, situated between the forceps members, which may be raised or lowered with respect thereto by means of a wing nut at the upper extremity.

In use, the hook is extended sufficiently to allow it to pass beneath the muscle. By means of the wing nut at the distal end of the instrument, the section of muscle to be included in the tuck is drawn up between the jaws of the forceps. When the operator feels a sufficient length of muscle has been included, the forceps is closed by means of round nut at the side of the instrument. A double suture is then passed through the notch at the end of the instrument, between the instrument and sclera. The needle is removed by cutting the suture, and the one part is tied above and the other below, including all the muscle fibers.

Dr. Frank Burch of St. Paul has devised an instrument somewhat similar to that of Harrison. His instrument may be had with either one or two notches at the lower end for carrying the sutures between the instrument and sclera.

---

18. Bishop, Wesley: A Tendon Tucker, Am. J. Ophth. **2**:195, 1919.

19. Harrison, William J.: Muscle Tucking Instrument, Tr. Am. Ophth. Soc. **26**:307, 1928.

INSTRUMENT DESIGNED BY AUTHOR

The instrument designed by me consists of two essential parts: The first part is made up of two movable wings, which are hinged at the top, so that they may be opened and closed by a small thumb screw at the side. A cross-bar at the lower end of each jaw, with a large window above in the one wing and a narrow slot in the other provides protection to the sclera and eyeball proper. The second part consists of a movable hook, which serves to draw up the section of tendon and muscle to be included in the tuck.

It is accurately pictured in figure 1. The instrument indicated as two-third size is closed. In figure 1, *1*, it has been opened, and the muscle hook run down. Figure 1, *2* illustrates its small size when closed, and figure 1, *3* pictures the tuck that is produced.

THE OPERATION

Before the operation is performed, the amount of the squint is accurately measured, and the refractive error determined, atropine being used in children and young adults.

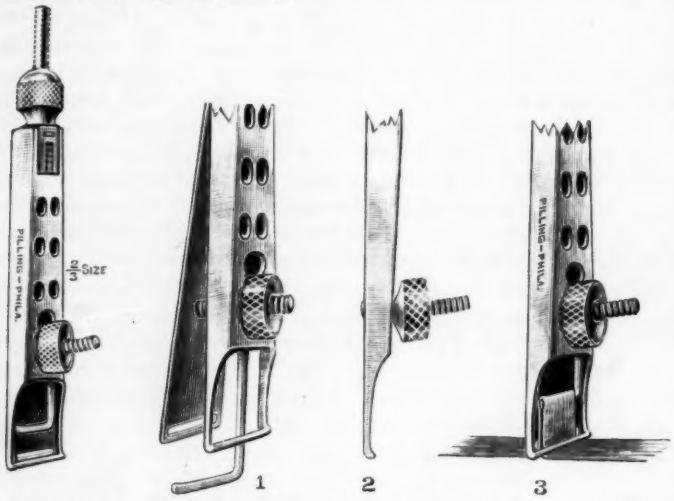


Fig. 1.—Maker's cuts of instrument. The two-thirds size cut represents the instrument closed; *1* shows the muscle hook run down to be inserted beneath the freed muscle; *2*, the small size of the instrument when closed; *3*, the tuck in full view ready for sutures.

The accompanying drawings were made from life by Mr. F. F. Faber, of the University of Pennsylvania, and illustrate the various stages of the operation.

Ether anesthesia is employed in all children. Local anesthesia is employed in most adults, and is induced by instillation of a few drops of 4 per cent cocaine and deep injection of 2 per cent procaine hydrochloride solution. Superficial subconjunctival injection should not be employed since it produces thickening of the subconjunctival tissues, with resulting loss of landmarks, which renders more difficult the location and isolation of the muscle. In the operation the ordinary rules of asepsis apply. With speculum in position, a vertical incision is made in

the conjunctiva exposing the muscle. Tenon's capsule is opened just above and below the insertion, and a strabismus hook carried beneath the muscle. A second strabismus hook is carried beneath the muscle from the opposite side, and the muscle exposed and freed from the surrounding tissue (fig. 2). It is important that the muscle be completely freed as illustrated. The under surface of the muscle is scarified with a chalazion curet, or better still, with Harrison's scarifying curet. This promotes adhesion formation when these surfaces are brought together. While the assistant holds the strabismus hooks, supporting the exposed muscle as illustrated (fig. 2), the surgeon opens the instrument so that the cross-bars at the lower end are about 5 mm. apart and runs the hook down (fig. 1, *1*) so that it may be passed beneath the muscle (fig. 3). The large window in the

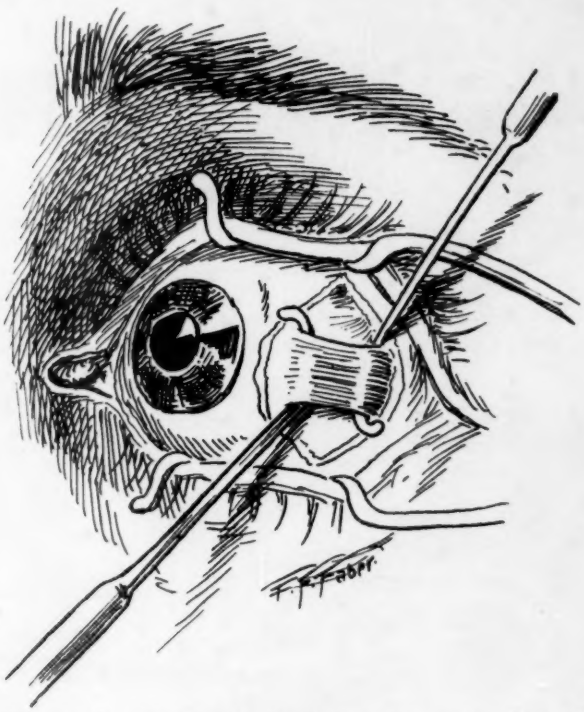


Fig. 2.—The muscle exposed and freed from the surrounding tissues, with strabismus hooks beneath.

instrument should be to the front. The cross-bars at the lower end of the instrument should rest flat on the surface of the muscle.

By turning the nut at the end of the instrument, the hook is drawn up, making the desired tuck (fig. 4). The threaded shaft at the end of the instrument has transverse markings (indicated by the arrow). These enable the surgeon to know something of the amount of tuck he is getting. When the first mark appears above the nut, the tuck is beginning, and when the second appears, 2 mm. of shortening has been obtained. The markings on the threaded shaft are 1 mm. apart. Each space represents 2 mm. of shortening (the tuck being double). It is usually assumed that 1 mm. of shortening will correct 5 degrees of squint. This, however, is subject to certain modifications, to be explained later. The transverse markings on the movable threaded shaft are a great help in giving the surgeon

some idea as to how much shortening he is getting, but experience with judgment must govern chiefly at this point.

When the surgeon feels that he has a sufficient amount of shortening, he tightens the nut on the front of the instrument, bringing the jaws as tightly together as possible. The instrument is so constructed that the muscle or tendon cannot be injured by crushing. This stage is represented by figure 4. If it is found that too much or too little shortening has been produced, the nut at the side is loosened and the tuck is lessened or increased accordingly.

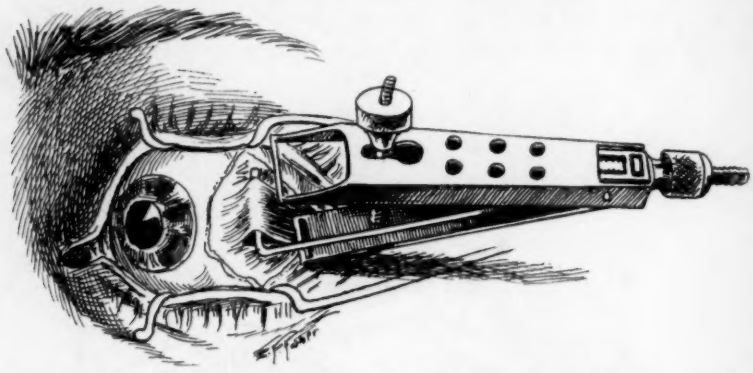


Fig. 3.—The hinged wings opened so that the cross-bars at the lower end are about 5 mm. apart. The muscle hook run down and passed beneath the muscle.

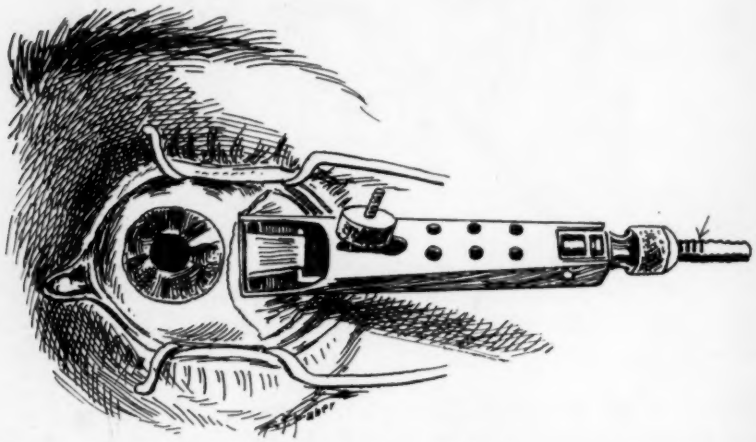


Fig. 4.—The tuck drawn up and the jaws of the instrument approximated by turning the small nut at the side.

With a half-curved needle, a suture of oo ten-day chromic catgut is carried from before backward through the tendon just above the cross-bar (fig. 5*a*) and out through the window on the back; it is brought back in like manner (fig. 5*b*) through the same window near the edge of the muscle. Two such sutures are used, being so placed as not to include the middle third of the tendon. This is important, as sloughing may result if all the fibers are included and no provision made for collateral circulation. During this part of the operation, it is well for

an assistant to grasp the cut edge of the conjunctiva just back of the instrument and hold it slightly away, so that it will not be included in the sutures.

After the sutures are tied, the instrument is removed by loosening the nut first at the front and then at the end, or by giving first one and then the other a partial turn. The tuck then appears as shown in figure 6*a*. The conjunctiva is closed with two or three black silk sutures.

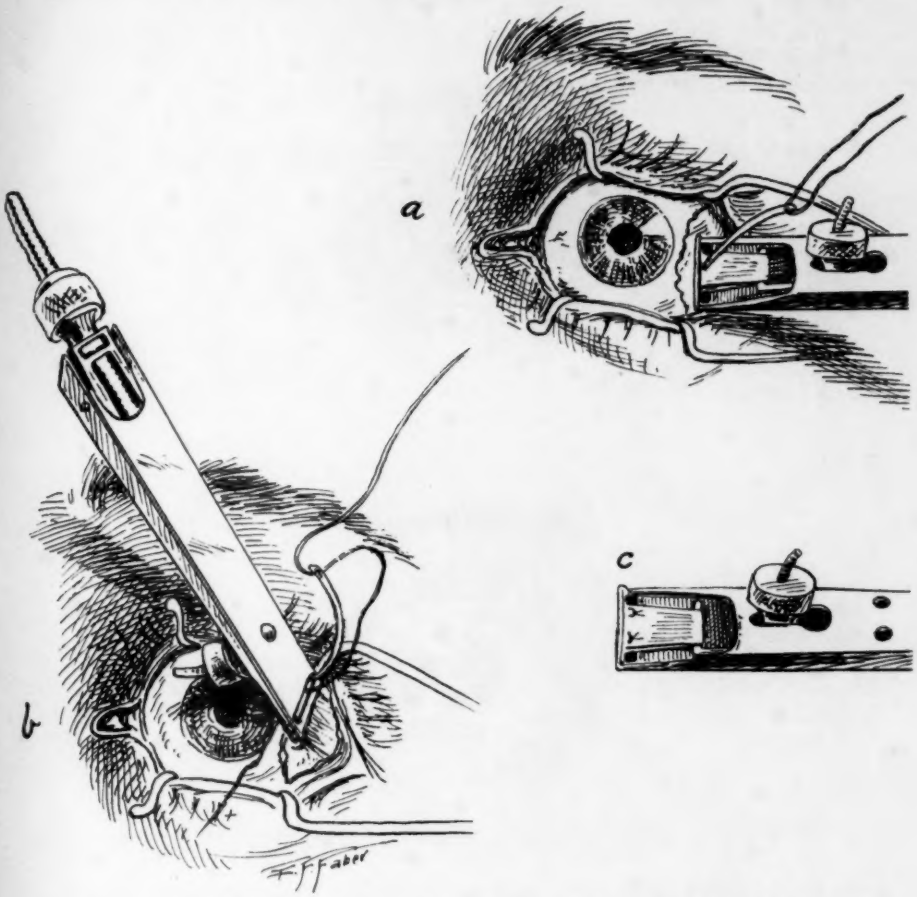


Fig. 5.—Insertion of the sutures: *a* shows the needle being inserted above the cross-bar from the front; *b*, the needle being carried back to the front through a slot at the back of the instrument near the upper edge of the muscle; *c*, the sutures tied in position.

Instead of closing the conjunctiva in this way, a "guy suture" of silk carried through the loop of tendon by a straight needle and tied after the manner of Bruns, already described, may be used and has a threefold advantage: first, it buries the two catgut sutures more deeply; second, it enables the operator to increase the shortening somewhat if needed, if drawn tightly when tying; third, it supports the tuck while adhesion is taking place.

The dressing and after-care are matters of choice, depending on the preference of the individual surgeon. It is my custom to bandage both eyes for two days, at the end of which the bandage is removed, the eye bathed with a 1:10,000 solution of mercurophen (sodium-oxy mercury-orthomtraphenolate) and the conjunctival sutures are removed. Only the eye on which operation has been performed is rebandaged, and is dressed daily after this for five days, using the same solution for irrigation. If a "guy suture" has been used, it should be removed from the fourth to the sixth day after operation. After a week the bandage is left off, and the eye is irrigated every three or four hours with a saturated solution

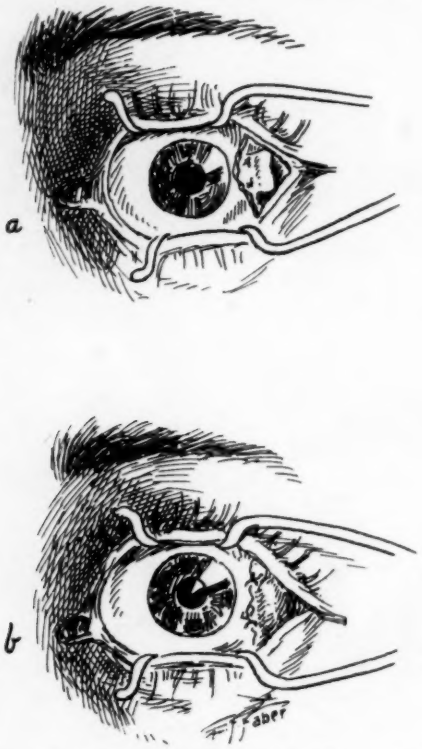


Fig. 6.—*a* shows the instrument removed; *b*, the conjunctiva closed.

of boric acid. In hyperopic eyes which are not overcorrected, lenses are worn constantly. Atropine in 1 per cent solution is used in undercorrected cases, and the correcting lenses worn constantly.

There are a few factors that may serve to alter the correction one gets with a given amount of shortening. Chief among these is the pull of the opposing muscle. If some lengthening operation on the opposing muscle is not employed one is likely to be disappointed in the result obtained. Complete tenotomy may destroy the power of convergence. While it is not within the scope of this paper to go into this important phase, I find the method of Lowell [20] satisfactory. Another factor to

20. Lowell, W. H.: Measured Correction of Squint by Combined Technique, Am. J. Ophth. **12**:173, 1929.

be considered is a lack of development of the fusion faculty. Prior to operation the amblyoscope is of value, and after operation the stereoscope should be used in an effort to develop fusion and secure binocular vision, which should be the ultimate aim in all cases.

TUCKING VS. ADVANCEMENT

Neither the tucking method nor the advancement method has been developed to the point where it is universally conceded that the one has an undisputed advantage over the other. It is true that many surgeons of broad experience practice the advancement method with excellent results. I prefer the tucking operation for the following reasons:

First, I have observed a less severe reaction after tucking than after advancement.

Second, there is always danger of injuring the important underlying structures when suturing to the sclera. This may occur at the time of operation, or later from infection.

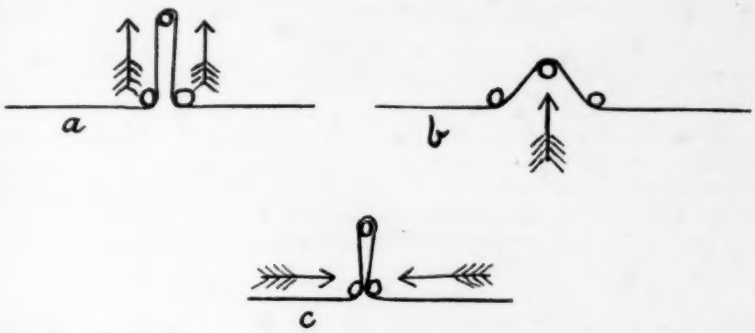


Fig. 7.—The traction as exerted on the muscle by various types of instruments. In *a* the arrows indicate the pull as exerted on the muscle when the instrument is used in which the muscle is drawn up between two fixed bars; *b* and *c*, the pull as exerted on the muscle in those types of instrument in which the jaws of the instrument are opened till the muscle is drawn up to the desired point and then closed.

Third, if for any reason the sutures do not hold, no harm has been done, and the amount of deviation is not increased.

These observations are based on experience more limited than that of many surgeons who adhere to the advancement method. Still, the results in all cases have been good. Approximate parallelism has been secured. With cooperative patients, binocular vision has often been obtained.

SUMMARY

A study of the operations herein reviewed will reveal the fact that in all the earlier operations for shortening the extra-ocular muscles no instruments were used that were devised especially for that purpose. In most operations described during the past thirty years, however, various types of instruments have been used that have in common the production of a tuck or fold in the muscle to be shortened, and of holding this

fold securely while being sutured in position. The advantage here gained is apparent, when it is considered that to produce parallelism without torsion exact fixation is imperative, and that one is here dealing with tissues that lend themselves to fraying or splitting in the long direction when traction is exerted on a suture placed through the belly of the muscle.

I have attempted to devise an instrument that is simple to operate, that occupies a minimum space in a limited field of operation, and that is exact in its results. It combines three points of importance, some of which are present in other instruments, but which are not all combined in any other instrument, so far as I have been able to learn.

First, the traction exerted on the muscle is less severe than in those instruments which have two fixed parts between which the movable muscle hook draws the tendon and muscle. This is illustrated in figure 7. Figure *7a* represents the pull on the muscle when drawn up between two fixed parts, as in Bishop's or Clark's instrument. Figures *7b* and *c* illustrate the first and second steps, respectively, in producing the tuck with my instrument, also that of Harrison and of Burch.

Second, the whole width of the folded tendon is in full view and accessible, so that the surgeon may so place the sutures as to include as much or as little as he may desire.

Third, the cross-bar at the lower end of each wing of the instrument fully protects the sclera and eyeball proper, since the needle carrying the suture is not carried between the instrument and the sclera, but above the bar and out through the slot at the back.

The instrument herein described is made by the George P. Pilling & Son Company, Philadelphia.

News and Notes

EDITED BY DR. JOHN HERBERT WAITE

GENERAL

Japanese Journal Gives Résumés in Other Languages.—In September, 1929, *Nippon Ganka Gakkai Zasshi,* published by the Japanese Ophthalmological Society, began to add to each article a short report in German, English, French and Esperanto.

Campaign Against Trachoma.—The International Anti-Trachoma Organization, the foundation of which was resolved on at the International Ophthalmological Congress in Amsterdam in 1929, was formed at Geneva during the last part of July. The meetings were held in the Palace of the League of Nations building. Forty delegates, the representatives of tweny-one different states, were present. Prof. Dr. Emile de Grosz was the presiding officer. The delegates had three tasks to perform: (1) to pass the statutes, (2) to form an executive committee and (3) to decide on the program of the near future.

The league's object is: (1) to further the cooperation of the various organizations for the prevention of trachoma; (2) to work with the international health organizations; (3) to follow all measures concerning the anti-trachoma campaign, to second these measures and to spread them; (4) to organize conferences to establish scientific bases of the anti-trachoma campaign, to elucidate problems of the etiology, diagnosis, treatment, extinction and prevention of this disease, as well as the scientific and social questions concerned; (5) to prepare the necessary legislative measures.

Prof. Dr. Emile de Grosz was elected president of the organization, to hold office for a period of five years. Elections to the other offices were as follows: secretary general, Dr. Wibaut, Amsterdam; secretary, Dr. Tewfik, Cairo; vice-presidents, Professor Angelucci, Naples; Professor Birch-Hirschfeld, Konigsberg; Dr. MacCallan, London; Professor Marquez, chairman of the International Ophthalmological Congress in Madrid; Dr. Morax, Paris; Dr. Park Lewis, Buffalo, and Professor Szymanski, president of the Polish Upper House. Other members of the executive committee are: Dr. Brandes, Antwerp; Professor Kadlikcy, Prague; Professor de Lapersonne, Paris; Professor Myishita, Tokyo, and Professor Van der Hoeve, Leiden.

The representatives of the Hygienic Committee of the League of Nations, Dr. Lutrario, former chief of the Italian Medical Department, and Dr. Jitta, chairman of the Dutch Board of Health, will join the organization. The representative of the International Association Against Blindness is to be Professor de Lapersonne of Paris, and that of the International Ophthalmological Council, Professor Van der Hoeve of Leiden.

The report of Dr. Lutrario and Dr. Jitta on trachoma was distributed by the Council of the League of Nations at the session. Dr. Olitsky of New York gave an address on behalf of the Rockefeller

Institute about the importance of the organism discovered by Dr. Noguchi, *Bacillus granulosis*. Dr. Addario of Palermo and Dr. Mayou, of London submitted demonstrations. The program was made complete by a lunch given for the delegates by Professor Gourfein at his Geneva clinic, and a dinner party arranged by Dr. André Patry, a Geneva oculist, at his French castle.

The countries that are obliged to prevent the introduction of the disease are in the same need of a campaign against it as the countries in which it is actually destroying eyesight. In Hungary the elements of this campaign were enacted as early as 1886 by a special law. The exertions of Japan in this respect are the object of general admiration. There are 1,000 trachoma examination rooms where half a million trachoma patients are treated by 1,000 physicians at an annual cost of half a million yen.

The League of Nations has issued a special circular letter to the governments requesting them to support the scheme.

Abstracts from Current Literature

EDITED BY DR. WILLIAM ZENTMAYER

Congenital Anomalies

A RARE CONGENITAL ABNORMALITY OF THE EYE. IDA MANN, Brit. J. Ophth. **14:** 321 (July) 1930.

The clinical history and photographs of the case described were furnished by J. N. Duggan, Bombay. The patient was a Hindu girl, aged 4 months. In place of the left eyeball there was a slightly movable, pedunculated, rounded swelling, 2 inches (5 cm.) in diameter. Posteriorly it was attached to a fibrous pedicle, about three fourths of an inch (1.9 cm.) in diameter. The normal eyelids nearly encircled the stalk just behind the posterior surface of the tumor. The surface covering of the mass resembled skin which passed imperceptibly into the conjunctiva covering the orbital cavity and the stalk.

The posterior pole was not obtained for histologic study. The mass itself was composed of fibrous tissue containing areas of fat showing myxomatous degeneration in places. The sclera and choroid were normal in structure. There was no trace of lens, anterior chamber, iris stroma, or ciliary muscle. The greater part of the mass was covered with pigmented skin. There was no trace of conjunctiva. The tumor was an aberration of differentiation of the mesoblast lying between the optic cup and the surface ectoderm. It must have begun to arise very early, as it had inhibited the growth of the lens entirely. The other accompanying deformities (skin instead of conjunctiva, faulty retinal differentiation and absence of the iris) were secondary to this primary fault and can be explained as attempted adaptations to altered environment.

This case belongs to that group of congenital fibrolipomas of the cornea which arise by an aberration of mesoderm at about the fourth week of development. According to Stargardt, they are true congenital anomalies and should not properly be classed as new-growths. From a pathologic point of view they belong to the group of monophyletic teratoblastomas, as they arise primarily from the aberration of one germ layer only. The skin and abortive retina are merely changes in surrounding structures secondary to the primary anomaly. The three cases of the same nature hitherto recorded are those of Swanzy and Leber, Hanke, and Stargardt.

W. ZENTMAYER.

Experimental Pathology

THE SURGERY OF THE VITREOUS. P. C. LIVINGSTON, Brit. J. Ophth. **14:** 330 (July) 1930.

After a brief summary of the surgical procedures in use for the cure of retinal detachment, the author states that his object is to examine the subject of retinal detachment by dealing not only with the detachment as such, but also with the whole vitreous body, should clinical observation reveal such a procedure necessary.

Dogs were used for the investigation which was designed to prove whether or not a tolerance existed, or could be established without undue reaction, between the vitreous of animals of the same species and that of animals of different species and whether vitreous retained in cold storage (for practical reasons) made any difference to the issue.

The technic is given in detail: It consisted essentially of withdrawing vitreous and replacing it with foreign vitreous by means of a syringe. On the surface, the results would appear discouraging, but as the work thus far is concerned solely with the question of tissue tolerance, and as only two of seven operations failed—one of these from immediate hemorrhage, which is beside the issue—the several cases show a satisfactory result. The experience gained leads to suggestions as to the proper procedure in carrying out this method of treatment in the human subject.

W. ZENTMAYER.

THE PROPERTIES OF THE CORNEAL SURFACE AFTER SECTION OF THE FIFTH NERVE. S. TAGAWA, Arch. f. Augenh. **102**: 231 (Dec.) 1929.

Rabbits were anesthetized with ethyl carbamate (urethane), and the ophthalmic division of the fifth nerve, the facial nerve, or the sympathetic nerve was sectioned intracranially. Following this the corneas were examined with the slit lamp and photographed by the method of reflex photography devised by Fischer. The author gives in detail the technic for section of the nerve. In every case complete section of the nerve was proved by a postmortem examination at the end of the experiment. He found that after section of the fifth nerve there occurred a desquamation and swelling of the epithelial cells beginning five hours after the section. Thirty minutes after the section the surface of the cornea was entirely normal but the tears had changed somewhat in consistency, being mixed with a fatty substance which gave a definite iridescent effect. The same effects were observed after section of the facial nerve but occurred definitely later.

In cases in which the trigeminus was sectioned a regular groove formation occurred in the cornea which was seen only after section of the facial nerve in animals that were not narcotized. This seemed to demonstrate that the first results of section of the trigeminus or the facial nerve are identical. Since the facial nerve does not innervate the cornea, these changes cannot be the direct consequence of section of the facial nerve, but this section probably causes a stimulation of the trigeminus. The facial nerve gives off in its course branches that go to the trigeminus to innervate the lacrimal gland in conjunction with it. Section of the facial nerve destroys these connections and leads to a change in the composition of the tears. It is not possible to produce pictures similar to those described by changing experimentally the composition of the tears, but if one creates an artificial lagophthalmos one can produce the same changes.

Experiments were done which showed that drying the cornea was not the immediate cause of the changes. The author believes that section of the trigeminus produces a trophic effect similar to that proposed by Tschermak. According to this theory, every organ supplied with nerves depends for its proper metabolism on the constant influence of

nervous impulses going to it which tend to regulate the permeability of membranes and to influence the condition of the plasma colloids in the cells. When these nervous impulses are interrupted, the metabolism suffers so that the tissue is unable to withstand outside deleterious influences and necrobiosis results.

Section of the sympathetic nerve led to no changes in the cornea. The author believes, therefore, that keratitis neuroparalytica is due to a trophic influence the result of interference with nerve impulses normally going to the cornea by way of the trigeminus.

F. H. ADLER.

"TRINKVERSUCH" AND GLAUCOMA. E. LÖBECK, Arch. f. Ophth. **123:** 728 (March) 1930.

The Trinkversuch is a test for the function of the endothelium of the capillaries, first devised by Siebeck and Marx. It consists of the observation of the hemoglobin content of the blood and of the specific gravity of the urine after the drinking of 1,000 cc. of water on an empty stomach. The normal person gives a typical curve, indicating the dilution of the blood (hemoglobin curve) and the restitution to the status quo ante by elimination of water (urine curve). Siebeck and Marx found that the hemoglobin curve led to results which differed from those obtained in normal persons, and in patients with contracted kidney, nephritis, heart diseases, and disturbances of internal secretion. The author laid special stress on the point that in a pathologic case, the hemoglobin curve and the urine curve must be anomalous while the quantity excreted after the Trinkversuch is of minor significance.

Schmidt (Bonn) applied the Trinkversuch to cases of glaucoma and came to the conclusion that in all his cases of glaucoma the Trinkversuch indicated a general and local (intra-ocular) disturbance of the capillary endothelium.

In the present paper Löbeck, a co-worker of Seidel, tries to prove that Schmidt's conclusions are not justified. The curves that Schmidt obtained from his patients were by no means typical for a disturbance of the capillary endothelium. Most of them were merely different from the normal hemoglobin and urine curves. Löbeck explains Schmidt's observations from the standpoint of the school of Seidel, assuming that the main difference between a normal and glaucomatous eye is the lack of porosity in the latter. The paper does not contain any new facts confirming this point of view.

P. C. KRONFELD.

General

MULTIPLE OCULAR LESIONS DUE TO STRONG COMPRESSION OF THE THORAX. NICOLAU, Soc. Român. de oftal., Bucuresti **11:** 98 (Dec.) 1929.

A boy, aged 15, who had fallen down between an iron gate and a lift, was drawn out in an unconscious state, with severe epistaxis. Ophthalmoscopy after eight days revealed marked conjunctival hemorrhages and a slight dilatation of the retinal veins; retinal edema sur-

rounded the retinal vessels. The pathogenesis of the ocular lesions was explained by the passive venous stasis due to the compression of the thorax.

N. BLATT.

Glaucoma

THE PSYCHIC INFLUENCE ON THE ORIGIN OF INCREASED INTRA-OCULAR TENSION. I. KRASSO, Ztschr. f. Augenh. **70:** 355, (March) 1930.

A careful and systematic study was made of a patient, aged 24, who for six years showed considerable difficulty in reading. It was noted that an increased intra-ocular tension (from 40 to 60 mm. of mercury) was present during this encumbrance. The visual acuity and the fields of vision appeared to be normal. An examination of the fundi revealed no pathologic disturbance. The question arose as to whether the author was dealing with glaucoma produced by a disturbance of the sympathetic nervous system or a transient increased intra-ocular pressure. No definite conclusion was attained, even though Krasso employed practically every procedure which of late years has proved helpful in diagnosing incipient glaucoma. The method of examination, together with the commentaries advanced by several writers, is meticulously described and analyzed. Every ophthalmologist should read the original article.

A. M. YUDKIN.

THE GROUNDS FOR PHYSICODIETETIC TREATMENT OF GLAUCOMA. E. A. HEIMANN, Ztschr. f. Augenh. **71:** 82 (April) 1930.

Heimann considers glaucoma as an angioneurotic edema produced by an imbalance between the sympathetic and the parasympathetic nervous systems. This disturbance is manifested by a pathologic permeability of the walls of the blood vessels. The factors that produce this alteration are toxic or hormonal. Physical disturbance may also provoke a glaucomatous attack. He mentions the several therapeutic measures that are utilized to decrease intra-ocular tension. All of these procedures seem to act on the sympathetic and parasympathetic systems. He advocates various water cures, external and internal, to alleviate the disease process. Lastly, he gives a salt-free diet, which has helped a number of his patients.

A. M. YUDKIN.

CLINICAL INVESTIGATIONS ON THE EFFECT OF GYNERGEN IN GLAUCOMA. MANOLESCU-ABRAMOVIC, Soc. Român. de oftal., Bucuresti **10:** 552 (Feb.) 1929.

Fifteen glaucomatous patients, presenting chronic, simple, chronic irritative, acute, absolute and secondary glaucoma forms, were examined. They took six tablets of gynergen of 1 mg. each per day by mouth. The investigations confirmed the favorable antiglaucomatous action of this preparation, as Thiel has already pointed out. In most cases, its action resulted in hypotonia, particularly when pilocarpine was instilled into the diseased eye at the same time. The best effect was obtained in simple glaucoma, but in the absolute forms, too, it was posi-

ble to obtain a decrease in tension. According to the majority of authors, the pharmacodynamic action of gynergen is due to the paralyzing effect it exerts on the sympathetic nerve. N. BLATT.

Lacrimal Apparatus

ACUTE BILATERAL DACRYO-ADENITIS DURING URETHRITIS. E. PANICO, Ann. di ottal. e clin. ocul. **58:** 59 (Jan.) 1930.

In a girl, aged 17, with gonorrheal urethritis, cervicitis and arthritis of one knee, swelling of both lacrimal glands developed. Mobility was slightly limited up and out, and the upper lids were much swollen. Gonococci could not be found in the scanty secretion. The condition cleared up in a week under hot packs and injections of gonococcus vaccine. Seventeen cases were found in the literature, all running a benign course, with suppuration in only a few. Most of the cases were bilateral, and arthritis was often present. Gonococci were found in the secretion of only a few cases, and marked conjunctivitis was never present. The author believes that it is uncertain whether gonococci, or only their toxins, reach the lesion through the blood stream.

S. R. GIFFORD.

ACUTE SUPPURATIVE DACRYO-ADENITIS CAUSED BY STAPHYLOCOCCI. C. JONESCU, Soc. Român. de oftal., Bucuresti **11:** 99 (Dec.) 1929.

A boy, aged 14, showed swelling of the right palpebral region, pain and fever. There were several furuncles over the body. The lacrimal gland protruded markedly into the conjunctival sac. Slight exophthalmos and downward deviation of the globe were present. The paranasal sinuses were intact; a blood culture was negative. Fluctuation occurred after three days. Incision was done, with recovery. The pus contained staphylococci. Acute suppurative dacryo-adenitides are rare; the case in question was a blood-borne infection. The furunculosis was considered as the point of origin. N. BLATT.

Methods of Examination

A MODIFICATION OF THE GREY BACKGROUND TEST. F. A. WILLIAMSON-NOBLE, Brit. J. Ophth. **14:** 412 (Aug.) 1930.

This article concerns the astigmatic chart with a gray background (Friedenwald). The modification consists in the addition of a second "V," and the object is to enable the surgeon to call the patient's attention to two lines at right angles to each other and to work only on these two lines. By this means one can avoid much of the confusion that arises from the answers of patients with irregular astigmatism. The method of its use in practice is described. W. ZENTMAYER.

A NEW METHOD OF OPHTHALMOSCOPY WITH FOCAL LIGHT. A. ZAMENHOF, Arch. f. Ophth. **124:** 87 (April) 1930.

The examination of the eyeground with focal light is of great importance. Wolff was the first author to work out a rather crude method that never became very popular. Koppe introduced the slit-lamp

into ophthalmoscopy, but his method turned out to be too complicated and too limited for general use. Zamenhof has devised a small instrument, the "focalizator," which is used with the simplified Gullstrand of Zeiss. The focalizator consists of a biconvex lens of 33 diopters, which is put between the slit and the ophthalmoscopic lens, very near the former. The focalizator can be moved backward and forward, and thus an image of the slit is cast in the plane where the image of the fundus appears. The author apparently does not know of Friedenwald's new ophthalmoscope, in which a similar principle is used. He made the observation that the use of focal light for ophthalmoscopy is (in spite of the great intensity of light acting on a small area) less dazzling for the patient than the diffused light of the ordinary ophthalmoscope.

P. C. KRONFELD.

Neurology

RECURRENT SEROUS MENINGITIS WITH OCULAR SYNDROME. D. SABBADINI, Riv. oto-neuro-oftal. **7**: 20 (Jan.-Feb.) 1930.

The simplest form of intracranial hypertension is that of serous meningitis. The etiology and the course of this interesting disease, in which the spinal fluid is normal while under increased pressure, are still in question. The author has set himself the task of clarifying its course, basing his experience on five cases studied during a period of ten years. He is the first to describe the occurrence of true relapses occurring from six months to ten years after a first attack. A relapse is considered strictly as the reappearance of the disease after a total disappearance of signs and symptoms. It was not in this sense that H. Claude (1922) and Caramazza (1927) described a relapsing form. Ophthalmologists (Di Marzio, 1925, and Caramazza) were the first to establish changes in the fundus as the most constant observations in serous meningitis. These consist of edema of the papilla and retina or of the retina and macula, with tortuosity and hyperemia of the vessels of the disks, especially the veins. Sabbadini maintains that these are the last signs of the disease to disappear, even after absolute subjective well being. Therefore, he concludes that their absence must precede a true relapse. Clearer prognosis and therapy result.

V. R. SYRACUSE.

Ocular Muscles

THE PROLONGED OCCLUSION TEST. F. W. MARLOW, Brit. J. Ophth. **14**: 385 (Aug.) 1930.

This article was called forth by the reference to this test in Maddox's paper on heterophoria. The conclusions based on the observations of about 1,400 patients are stated categorically with the reason for their adoptions. It is stated that low degrees of esophoria are always open to suspicion and often change to a hyperexophoria. Lateral deviations of moderate or low degree should not be ignored. Prisms are of high value for lateral deviations as well as for vertical, though not degree for degree. The constant wearing of prisms does not tend to increase the total deviations. Prism abduction bears no constant relation to the amount of exophoria. Postocclusion exophoria may greatly exceed the preocclusion abduction. The results of treatment

on the postocclusion basis are far superior to those on the preocclusion basis. The phorias (excepting perhaps some cases of esophoria), prism abduction and sursumduction and deorsumduction, which are nonpurposive in man, can best be explained on the theory that they are persistent vestiges of functions originally useful when panoramic or circumferential vision was important. Hyperphoria often varies in degree and even in kind. In different parts of the field of fixation, showing insufficiency of one or more muscles, it is important to measure not only the deviation, but the sursumduction and the deorsumduction after occlusion; the occlusion test usually makes no material difference to the near point of convergence. The blurring in the distance that sometimes accompanies a full correction of hyperopia is often due to accommodation spasms secondary to the convergence efforts necessary to overcome a deviating tendency (exophoria and hyperphoria), which may be quite latent. A diminution in the degree of myopia occasionally follows the correction of a muscle imbalance, the necessary corollary of which is that the determination of the muscle imbalance is an important factor in the prophylaxis of myopia. Exercise has probably no influence on the relative (anatomic) position of rest. Hyperphoria, usually associated with a lateral deviation, is the commonest form of heterophoria, exophoria being a close second, esophoria being comparatively rare. The rest of the paper is more or less controversial.

W. ZENTMAYER.

TRAUMATIC PALSY OF THE INFERIOR OBLIQUE MUSCLE. A. LUTZ, Arch. f. Ophth. **123:** 721 (March) 1930.

Only thirty-eight cases of palsy of the inferior oblique muscle have been reported so far. Lutz' case was that of a cowboy who was hit on the left cheek by a steer's hoof. The eyeball was not injured. The malar bone was fractured and the floor of the orbit was infracted. The inferior oblique muscle was completely paralyzed at first, but its function gradually improved almost to normal.

P. C. KRONFELD.

MOTOR PARALYSIS OF THE EYE DUE TO LUMBAR ANESTHESIA. LAZARESCU, Soc. Român. de oftal., Bucuresti **10:** 553 (Feb.) 1929.

Lazarescu describes five cases. In four cases the palsy of the abducens nerve was due to procaine hydrochloride anesthesia, and in one case to benzoyl-dimethyl-amino-ethylpropanol hydrochloride. In two cases there was a concomitant herpes labialis. As regards pathogeny, the author adheres to the leptomeningitic theory of Terrien.

N. BLATT.

Operations

FACTORS DETERMINING THE ADVISABILITY OF SELECTIVE OPHTHALMIC SURGERY. L. W. FOX, Brit. J. Ophth. **14:** 393 (Aug.) 1930.

Much of this paper does not lend itself to abstraction. Some points of interest in the author's judgment are: In the presence of glycosuria, one should operate on all patients provided the glycosuria does not exceed 3 per cent. According to Petty, in the light of modern work

the condition should be regarded in terms of blood sugar; thus, patients with blood sugar up to 170 will tolerate ophthalmic operations.

The author is inclined to regard the association of diabetes with detrimental conditions of the eye as somewhat exaggerated.

In high blood pressure, unless hemorrhages have occurred within the eye to the extent that vision is already irreparably ruined, it is not to be considered as a contraindication for operation on the eye. The technic in operations on the cataract includes preliminary canthotomy, and the degree of hemorrhage following this may be taken as an index of the bleeding possibilities when the globe is subjected to operation. The functional activity of the kidney is of more concern than the structural lesions determined by urinalysis. The quantity of elimination in twenty-four hours is more important than the mere presence of albumin and casts. In prostatic enlargement there is no objection to the patient's using the commode six hours after operation. If the patient harbors the impression that he is restrained and must keep flat on his back for twenty-four hours, or until the next visit of the physician, one need not be surprised if retention of urine, vesical spasm and mild delirium supervene.

W. ZENTMAYER.

OPERATIVE PROCEDURE FOR THE CORRECTION OF PALPEBRAL PTOSIS. MARIO ESTEBAN, Arch. de oft. hisp. am. **39:** 658 (Nov.) 1929.

Correction of palpebral ptosis consists essentially in the suture of the levator palpebrae to the superior rectus, the following being the steps of the operation: 1. After eversion of the upper lid, and uncovering of the retrotarsal fold by hooks applied to the tarsus and scleral conjunctiva, a horizontal incision, 2 cm. in length, is made in its center. 2. The levator palpebrae and the superior rectus are isolated and carried on respective squint hooks or Prince forceps. 3. A double suture is passed, one through the levator insertion and the other into the superior rectus as far back as desired. The levator may be cut or its surface simply freshened, the sutures then being tied. The conjunctival wound is finally sutured.

The author considers the operation more simple than Motais': The complications are more easily dealt with, a more accurate graduation of the effect is obtainable without any reduction in the functional capacity of the rectus, and other minor advantages are noted.

C. E. FINLAY.

A METHOD OF REPAIR OF THE CONJUNCTIVAL SAC. GHICA, Soc. Român. de oftal., Bucuresti **11:** 33 (Nov.) 1929.

In a case of trachomatous entropion and almost total symblepharon, the author's method, consisting in the use of a skin flap taken from the inferior eyelid, gave very good results.

N. BLATT.

Orbit, Eyeball and Accessory Sinuses

ORBITAL CELLULITIS IN CHILDREN. E. T. SMITH, Brit. M. J. **2:** 14 (July 5) 1930.

Smith reports three cases. He says: Apart from cases of orbital cellulitis due to facial infection, in which the orbital condition is only

an incident in a fatal septicemia, there are two main causes. The first, and the most common, is nasal sinus infection, with outward displacement of the proptosed eye and not severe general illness. Here the rhinologist can give most help; and, if he is called in early, incision into the orbit will probably be avoided. The second is metastatic osteomyelitis or periostitis of the orbital walls, with severe illness and fever and central proptosis. Early incision (as in the analogous disease of the long bones and epiphyses) is essential if the eye is to be saved. When once the orbital tissues are thoroughly infiltrated and edematous it seems to be difficult or impossible to bring about resolution before the cornea has sloughed, owing to interference with its circulation as well as to exposure. The aim should be to prevent this phlegmonous condition by prompt incision down to the bones involved; hence the importance of early and accurate diagnosis. In every case of a pink and swollen eyelid the general practitioner should realize the significance of proptosis, if this exists. In its absence he may temporize; in its presence he should act with decision. No case of inflammatory exophthalmos should be regarded lightly.

[J. A. M. A.]

Traumatic Pulsating Exophthalmos; Hemiplegia, Intracranially Retained Bullet. Lazarescu-Varlic, Soc. Român. de oftal., Bucuresti **10:** 553 (Feb.) 1929.

The author reports a case in which a bullet from a revolver entered the eye through the inferior eyelid and was retained in the occipital region. The exophthalmos was due to an arteriovenous aneurysm.

N. Blatt.

Physiology

Modern Views on the Sensory Mechanism of Vision. G. La Cascio, Ann. di ottal. e clin. ocul. **58:** 107 (Feb.) 1930.

La Cascio's inaugural address as Professor of Ophthalmology at Padua deals mainly with the receptive apparatus in the retina. The enthusiasm aroused by Boll's discovery of the visual purple was lessened when it was found that this is absent from the cones and the fovea centralis, and that it is doubtful if it is present in the human retina. Angelucci studied the migration of the pigment epithelium between the rods and cones, and the contraction of the outer elements of the rods on exposure to light. He found that light of shorter wave length produced more effect than that of long wave length.

Engelmann showed the relation of these phenomena to the central nervous system, since exposure of one eye to light produces the same effect on the opposite eye held in the dark. This is not true of the paling of the visual purple, which depends on the direct effect of light.

Angelucci and Lodato also described chemical changes in the retina under the influence of light, its oxidizing power increasing and its reaction changing from neutrality to a slight acidity.

Nakashima and Hayashi demonstrated an increase in electric potential but no increase in oxidation consumption as shown by Warburg's method. Working with the retina of rabbits, the author confirmed the

Japanese investigators' observation, but was able to demonstrate an oxidation process in the retina which is greater in the dark than in the light. He found that during exposure to light small quantities of phosphoric and lactic acid are formed. This may be the result of the contraction of the myoid elements of the cones, the acids being produced, as in the muscles, by the transformation of chemical into kinetic energy. The studies of Du Bois Reymond and of Holmgren have shown that an electric current is generated by exposure of the retina to light.

Various theories that take these phenomena into account are considered. Since the photochemical effect of light is produced only in tissues which absorb it, there seems reason to believe that photochemical changes are produced in the pigment epithelium, the rods and cones being secondarily stimulated by such products, whether these are freed electrons or vibrations of varying wave length. Angelucci believes that ionization of some substance is produced which sets free electric currents. The author believes that no theory can yet be considered as definitely proved.

S. R. GIFFORD.

A REMARKABLE LAYER OF RETINAL CAPILLARIES. E. P. FORTIN, Arch. de oft. de Buenos Aires **5:** 166 (March-April) 1930.

A colored plate of the internal granular layer of the retina with its capillaries is shown; it was observed entoptically by means of a simple apparatus in which reflected rays of the sun pass through an ordinary 3 diopter lens and two uviol and three ground glass plates.

C. E. FINLAY.

MEASUREMENTS OF THE COMPENSATORY ROTATION OF THE EYES CAUSED BY LATERAL TILTING OF THE ENTIRE BODY (IN NORMAL PERSONS AND IN PATIENTS WITH UNILATERAL AND BILATERAL LOSS OF VESTIBULAR FUNCTION). M. H. FISCHER, Arch. f. Ophth. **123:** 476, 509 (Jan.) 1930.

Fischer found that the greatest amount of compensatory rotation is obtained when the entire body is tilted laterally about 60 degrees. The amount of rotation in this position varies from 5 to 12 degrees in various subjects. The compensatory rotation is caused by gravity, which acts on the so-called "graviceptors" (A. Tschermak) which are mainly located in the labyrinth. In the same experiments the location of the subjected vertical line was also determined. A vertical line must (to a certain extent) be tilted in the same direction as the body of the person examined is tilted, in order to appear vertical. In certain positions of the body (150 degrees to the right or left) the examined person cannot make any definite statement about the subjected vertical line. Sometimes the person reluctantly declares that the axis of the body which is tilted 150 degrees against the objective vertical line is the subjective vertical line. This is a peculiar combination of absolute and egocentric localization. No relation could be found between the amount of compensatory rotation and the subjective vertical line.

The same experiments were carried out on a patient whose one labyrinth had been destroyed by radical operation, and on another patient who had lost the function of both labyrinths after typhoid fever.

The latter did not show any compensatory rotation of the eye when his entire body was tilted laterally. It can therefore be concluded that the compensatory rotations are reflexes that originate in the labyrinth. If only the head was tilted or the body was bent laterally some rotatory movements occurred. These rotations represent reflexes which originate in the sensory nerves of the region concerned (the neck or the hip). Without function of the labyrinth the patient was able to give definitely the location of the subjected vertical line. He still possessed a certain absolute conception of space.

P. C. KRONFELD.

Retina and Optic Nerve

A CASE OF SPASM OF THE CENTRAL ARTERY OF THE RETINA. NASR FARID BEY, Brit. J. Ophth. **14:** 402 (Aug.) 1930.

The patient was a physician, aged 42, with a history of frequent attacks of angina pectoris. There was no evidence of arterial degeneration. The blood pressure was 130 systolic and 90 diastolic. During an attack of typhoid fever with inflammation of the gallbladder, the patient developed what was diagnosed as an embolism of the central artery of the retina of the right eye. Vision was 6/24 (six years previously, vision in this eye was limited to movements of the hands). The limits of the fields were normal, but there was a central scotoma. The fundus picture was that of obstruction of the central artery of the retina. Three and one-half months later, the vision was unchanged, but the scotoma was smaller. There was retinal atrophy. Five months later, the patient died during an attack of angina pectoris.

The author states that the reaction of the pupil is lost in embolism, because the course of the sympathetic nerve is cut, but in spasm, the reaction is still present

W. ZENTMAYER.

AMAUROTIC FAMILY IDIOCY—WAREN-TAY-SACHS' DISEASE. RÓMULO R. GIL and RAUL P. BERANGER, Arch. de oft. de Buenos Aires **5:**56 (Jan.) 1930.

A case of amaurotic family idiocy occurred in a child of the Latin race; the father was an Italian and the mother an Argentine of Spanish origin, with no collateral relatives of Jewish blood. The child, who was 2 years of age, showed a generalized atony with a characteristic ophthalmoscopic picture. The author gives a detailed description of the disease.

C. E. FINLAY.

Trachoma

MARITIME THEORY OF TRACHOMA AND ITS ETIOLOGIC BASIS. MERIDA NICOLICH, Arch. de oft. de Buenos Aires **5:** 53 (Feb.) 1930.

Although recognizing the contagiousness of trachoma, the author considers that several other factors enter into its production and propagation. The present work is based on statistics comparing its frequency in different districts of the same city and country. He comes to the conclusion that the vicinity to the sea has a marked influence in this respect. He concludes that trachoma has a double origin and mode of

transmission: (1) by contact from a patient to a healthy person, this being more frequent when the diffusion of the infecting agent is favored by poor sanitary conditions, and (2) by contact with infected or parasite-infested fish, in which the agent of trachoma probably has an extra-human cycle of evolution.

C. E. FINLAY.

Tumors

ENDOTHELIAL SARCOMA OF THE UPPER LID. T. FIORE, Ann. di ottal. e clin. ocul. **58:** 54 (Jan.) 1930.

A girl, aged 16, had noticed ptosis for the past year, and showed a thickening of the upper lid, which covered two thirds of the cornea. The conjunctival surface showed a hard, smooth, grayish swelling surrounded by papillary hypertrophy. The mass, including the involved tarsus, was removed, the defect being replaced by mucous membrane from the lip.

Sections showed a new growth involving the whole thickness of the lid, apparently arising from the tarsus. It contained numerous small vessels, the endothelium of which was continuous with the spindle-shaped cells making up the neoplasm. Hence the diagnosis of endothelioma or endothelial sarcoma seemed justified.

S. R. GIFFORD.

CONTRIBUTION TO THE PATHOGENESIS OF SARCOMA OF THE CHOROID. P. WÄTZOLD, Arch. f. Ophth. **124:** 139 (April) 1930.

In a previous paper (1928) Wätzold expressed the opinion that the extra-ocular spreading of tumor cells in cases of sarcoma of the choroid is much more frequent and occurs at a much earlier stage than had been formerly supposed. Therefore, he concluded that as soon as the diagnosis of sarcoma of the choroid has been made, an exenteration of the orbit should be done. This opinion has been the subject of many discussions during the last two years, because most of the German ophthalmologists and pathologists objected to it. Wätzold has now changed his mind, mainly because of several publications that came out in the meantime and because of a case that he observed. The diagnosis of sarcoma of the choroid was made in this case—that of a man, aged 50—in August, 1926. On September 16, an enucleation was performed. The histologic studies of the enucleated eye showed a sarcoma with perforation of the sclera, formation of a little retrobulbar growth and sarcomatous infiltration of the optic nerve up to the level where the optic nerve was cut. Eight days after the enucleation, the orbit was exenterated. The orbital contents and the orbital part of the optic nerve were found perfectly normal except for some lymphocytes. The patient has been in perfect health up to the date of the publication, almost four years. This case seems to prove that metastatic tumors or extra-ocular extensions of intra-ocular malignant tumors can be made to disappear by the removal of the primary tumor. The same observation has been made in many instances in general surgery. It is not known through what mechanism (phagocytosis, specific antibodies or enzymes?) the metastatic tumors are destroyed in these cases.

The mortality in the cases of uveal sarcoma in which treatment was given in the eye clinic of the University of Berlin is about 15 per cent.

if the results four years after the operation are taken as a measure. In Wätzold's opinion, this period is too short, and the patient should remain in good health at least seven years after the operation before he can be considered as cured. Wätzold agrees with von Hippel in the observation that metastatic tumors after operations in the second stage of the sarcoma are not more frequent than the metastatic tumors that occur after operation in the first stage. It can even be said that the prognosis in a case of sarcoma in the second stage without metastasis is better than the prognosis in the case of a sarcoma in the first stage. Wätzold admits that in a case of intra-ocular sarcoma without any symptoms of extra-ocular extension or metastasis the exenteration of the orbit does not protect the patient any better than the enucleation. Therefore, the latter seems to be sufficient and preferable in these cases.

P. C. KRONFELD.

TWO CASES OF LEUKOSARCOMA OF THE CHOROID. PUSCARIU, Soc. Român. de oftal., Bucuresti **10:** 552 (Feb.) 1929.

Of ten choroidal tumors, seven were melanosarcomas and three were leukosarcomas. The clinical and anatomicopathologic observations made in two cases of leukosarcoma are described; one belonged to the round cell and the other to the spindle cell type. The tumors had originated in the choroid itself.

N. BLATT.

Uvea

RADIOLOGIC DIAGNOSIS OF OSSIFICATION OF THE CHOROID. DEL DUCA, Saggi di oftal. **5:** 547, 1930.

The author shows the roentgen evidence of ossification demonstrated in six enucleated eyes. Placing these eyes in the empty orbit of the cadaver, he studied the various positions in which the bony change could be shown roentgenographically and concluded that the frontal position, with the nose and the mouth on the plate, the rays passing from the occiput to the root of the nose, is most advantageous. The lateral view may also afford information as to the extent of ossification in some cases. Observations on seven cases are described in which roentgenograms demonstrated bone in the choroid in vivo.

S. R. GIFFORD.

IDIOPATHIC FAMILY HEMERALOPIA—NIGHT BLINDNESS IN CHORIOCAPILLARY DEGENERATION. A. BARBIERI, Arch. de oft. de Buenos Aires **8:** 669 (Nov.) 1929.

This paper is based on the observation in a single Polish family, with no consanguinity, of four children, all females, three of whom had idiopathic hemeralopia. The eldest child had an enlarged thyroid, hypertrophied liver and muscular atrophy of the palms of the hands. The visual fields were greatly contracted; the photometric field measured from 20 to 30 degrees. The optic disks were normal. There were dark red and yellow striations in the choroid.

The second child was microcephalic, with a low mentality. The optic disks were small; the arteries were filiform, and there were plaques of choroid degeneration with fine yellowish and grayish punctiform granulations throughout the retina. The visual fields could not be determined.

The photometric field measured 15 degrees. The third child presented similar subjective observations. The fundus was normal.

The author believes these to be cases of so-called retinitis pigmentosa without pigment. The condition is to be attributed to a lack or diminution of retinal purple elaborated in the pigmentary layer of the retina, brought about by vascular atrophy of the choriocapillaris and of the retinal arteries, which degenerate from the periphery toward the center.

The etiologic factor is similar to a hepatic lesion or degeneration produced by chronic intoxications (syphilis, alcoholism, chlorosis). Because of this faulty regulation of the quantity of hematic pigment (bilirubin, hematoporphyrin, etc.), the excess of which in the blood may affect the photoesthetic substances in the retina, these processes coincide with the degree of anemia and diminution of the hemoglobin.

Treatment should be directed toward the etiologic factor, if discoverable, and toward improving the condition of the blood and the hepatic function; specific medication consists in the use of iron, opotherapy, cod liver oil, iodine and anactinic protective glasses.

C. E. FINLAY.

SPONTANEOUS SEROUS IRIS CYSTS. N. A. FILIPPOW, Klin. Monatsbl. f. Augenh. **84:** 247 (Feb.) 1930.

Spontaneous serous iris cysts are rare; their discovery is important as they may cause secondary glaucoma and may be mistaken for malignant growths. A number of well founded theories have failed to clear up their origin. Two cases are reported; one in a woman, aged 26; the other in a youth, aged 18. The cysts were removed in both cases. Exact histologic observations are given. One of the cysts had a capsule consisting of connective tissue. The first cyst, in the author's opinion, developed distinctly, the second, apparently on a predisposed iris. Injury could be excluded in the two cases. Early and radical removal of the cysts, including adherent iris tissue, and histologic examination are recommended.

K. L. STOLL.

HETEROCHROMIA FOLLOWING EXPERIMENTAL EXTIRPATION OF THE SYMPATHETIC. J. BISTIS, Ztschr. f. Augenh. **71:** 235 (June) 1930.

Bistis calls attention to the many authentic reports of changes in the pigment of the iris and other parts of the eye produced by the extirpation of the upper cervical sympathetic ganglion. The reported literature corroborates his work on this subject and refutes the statement of F. Poos that changes in color are due to the flattening out of the folds of the iris.

A. M. YUDKIN.

Visual Tracts and Fields

CONCENTRIC CONTRACTION OF THE VISUAL FIELDS. W. D. ROWLAND AND A. W. ROWE, Am. J. Ophth. **13:** 413 (May) 1930.

Of 1,900 patients seen in the course of a general diagnostic service, 102 showed concentric contraction of the visual fields. The following summary of these cases is made:

1. In addition to the commonly recognized causes of concentric contraction of the visual fields, such as optic and retinal atrophy, hysteria,

glaucoma and optic neuritis, this study illustrates the fact that several other disease conditions may produce a like result.

2. Of endocrine conditions, disorders of the pituitary seem to exercise a primary influence, and are not necessarily associated with hyperplasia of the gland. All but a very few of the cases with involvement of the thyroid gland and the gonads showing the condition of the eye demonstrate a complicating disease state such as is found in nonendocrine cases in association with the condition of the eye. For this reason disturbance of the thyroid or of the gonads is not to be regarded as of primary importance in analyzing the visual phenomenon, though as factors of minor importance these glands cannot be rigorously excluded.

3. In addition to the endocrine conditions, there is a sufficient incidence of changes in the eyes, in lesions affecting the central nervous system, in syphilis, tuberculosis and hepatic dysfunction, to warrant their consideration as probable causal agents of primary significance.

4. The laboratory studies give clearcut evidence of functional renal disturbances which are to be interpreted broadly as showing a frequency of metabolic disturbance in excess of that in similar groups without the characteristic observations in the eye.

5. From the points noted it seems reasonable to conclude that in patients demonstrating marked concentric contraction of the visual fields the possible presence of any of the foregoing conditions, as well as the commonly recognized entities, should be investigated in arriving at a diagnosis.

6. There are apparently many cases of marked contraction of the field in which the condition has not been detected.

W. R. Reese.

Therapeutics

A Report on the Use of Vitamin "A" in Conjunction with Ultra-Violet Light in Ophthalmic Diseases. J. D. M. Cardell, Brit. J. Ophth. **14:** 354 (July) 1930.

The period of observation extended over three years. The records of 181 cases are available. General exposures of increasing duration were given triweekly in serial rotation, so that the same surface of the skin was not exposed on two successive visits. The "courses" consisted of fifteen exposures. During the year preceding this report, vitamin A was given concurrently with ultraviolet light. The patients all stated that as the result of the treatment they ate and slept better and in most cases put on weight. The best results were obtained in phlyctenular ophthalmia, hordeola, episcleritis, corneal ulcers and tuberculous iritis. More deeply seated conditions, such as vitreous opacities, choroiditis and optic neuritis, do not improve to an extent which justifies the time required for the treatment. Tables are appended which show a comparison between 53 cases in which vitamin A was given and 86 cases without this addition.

W. Zentmayer.

Nasal Nerve Syndrome. Carlos Charlin, Arch. de oft. de Buenos Aires **5:** 132 (March-April) 1930.

The author reports a case of a rebellious atypical ulcerative keratitis the etiology of which was in doubt for a long time. It was accompanied

by severe ciliary neuralgia. Finding in one of the examinations that cocainization of the eye did not produce relief of the symptoms, he considered the case one of posterior ciliary neuralgia from a lesion of the ophthalmic ganglion. Investigations as to its etiology yielded a negative Wassermann reaction and negative results of urinalysis; the Widal reaction (obtained because of a preceding intestinal febrile reaction of several weeks' duration) was also negative. A careful examination of the history revealed that the painful crises which had occurred on two prior occasions were accompanied by a sensation of stuffiness in the nose. The author then thought of a lesion of the sphenopalatine ganglion and referred the patient to a rhinologist, who found an enormous septal deviation toward the right (the affected side); this lesion, however, should not cause ocular symptoms. A thorough examination of the sensitive innervation of this region showed the author that the symptoms were explainable only by neuritis of the nasal nerve. A cure was effected by repeated atomization of the nose with cocaine and epinephrine when the crises appeared, after a correction of his septal deviation. He does not consider the condition rare, and he believes that except when local conditions are present the lesion may be caused by any of the general conditions productive of neuritis.

C. E. FINLAY.

MALARIAL TREATMENT IN DISEASES OF THE OPTIC NERVE CAUSED BY SYPHILIS AND LOCOMOTOR ATAXIA. R. HESSBERG, Klin. Monatsbl. f. Augenh. **84:** 261 (Feb.) 1930.

Three of the eight cases published in 1927 (*Zentralbl. f. Augenh.* **62:** 155, 1927) could be observed for five years; the patients retained sufficient vision to make a living for from three to five years to the present time. A new series of eight cases is added; one of the patients was under observation for five years, three each since 1927 and 1928, and one since 1929. One patient regained full vision in one eye, while the other eye was improved. Three cases remained stationary. The patients were treated with malaria plasmodia until they had had nine elevations of fever; arsphenamine was then given. Iodine was recommended orally or intravenously. The body, as well as the optic nerve, reacts promptly to any therapy after the malarial treatment; hence the possibility of more rapid destruction of the optic nerve by arsphenamine after the malarial treatment. Patients with a weakened constitution are excluded. They should receive a preparation consisting of bacterial albumins derived from *Bacterium coli,* which are raised on milk and rendered nonpathogenic. Exact ophthalmologic and neurologic examinations are essential in either method.

K. L. STOLL.

TREATMENT OF DISEASES OF THE ANTERIOR SEGMENT OF THE EYEBALL WITH BUCKY'S GRENZ RAYS. I. KRASSO, Ztschr. f. Augenh. **71:** 1 (April) 1930.

From her experience with the grenz rays in animal experimentation Krasso calls attention to the salient differences in the reactions and the procedures necessary to procure favorable results in human eyes. Her study shows that rays are absorbed by the upper layers of the ocular tissue and are therefore available only for superficial therapy. The

procedure is a painless one, and the length of exposure is less than one minute. It is particularly beneficial in children when blepharospasm is present. The treatment can be repeated in a few days, for it does not seem to have an accumulative action. It has an analgesic effect soon after treatment.

Parallel with this alleviation of pain an inspection of the area treated can be made so as to determine the extent of reaction. It seems to have a similar analgesic effect in glaucoma. The treatment proved favorable in a case of lime burn in which persil had splashed into the eye. Herpetic eruptions of the cornea were improved. The author mentions the case of a patient with herpes who had weekly eruptions which were recalcitrant to ordinary treatments for seven months, but the patient was made free from photophobia by a few treatments with the grenz rays. Similar satisfactory results were observed in cases of keratitis dendritica, filamentous keratitis, keratitis punctata superficialis, infected erosions, serpiginous ulcers and superficial inflammations of the tissues of the lid. The deeper corneal afflictions did not seem to improve with the present technic.

The advantages of this therapy over radium or the roentgen rays are: (1) a shorter exposure to the light; (2) the painless application, (3) the shortening of the healing time, (4) the absolute safety of the irradiation to the deeper layers of the eye following slight penetration, and the security of the therapeutist because of the absorption of the rays by the air, (5) the possibility of repeated treatment in short intervals without the danger of accumulative effects, (6) the simple technic for its application and (7) the relative inexpensiveness of the apparatus.

A. M. YUDKIN.

TREATMENT FOR PARENCHYMATOUS KERATITIS BY MYOSALVARSAN. E. FARKAS, Orvosi szemle **3:**54 (Feb.) 1930.

A case of parenchymatous keratitis caused by congenital syphilis was completely cured by fifteen injections of myosalvarsan (totaling 2 Gm.) within two months. Myosalvarsan is an arsphenamine preparation entirely equivalent to neoarsphenamine, easy to inject intramuscularly and not at all painful.

N. BLATT.

Toxic Amblyopia

BLINDNESS AND AMBLYOPIA FROM QUININE. F. SCARDAPANE, Saggi di oftal. **5:** 62, 1930.

The author reports seven cases in which the visual disturbance was of varying degree. Several cases showed the typical constriction of the retinal arterioles, with pallor of the disk, while three showed a normal fundus picture. In all, the central vision, when not reduced from other causes, returned to normal. The fields were reduced in all cases, some defect being apparently permanent. The field for colors was much more reduced than that for white, and several cases showed a marked interlacing or inversion of the color fields. This fact, with the relatively slight damage to macular vision, makes the author reject the vascular theory, and is evidence in favor of a selective toxic action on certain nerve fibers or retinal elements.

S. R. GIFFORD.

Society Transactions

EDITED BY DR. GEORGE S. DERBY

NEW YORK ACADEMY OF MEDICINE, SECTION OF OPHTHALMOLOGY

WILLIAM F. C. STEINBUGLER, M.D., *Secretary*

May 19, 1930

ERNEST F. KRUG, M.D., *Chairman*

UNUSUAL MUSCLE ANOMALY FOLLOWING RADICAL FRONTAL OPERATION. DR. JAMES WATSON WHITE.

A woman had a radical frontal and ethmoid operation in June, 1929. She was first seen on Sept. 30, 1929. There was hyperphoria, 3 centrads in the primary position, which increased to a right hypertropia of 45 centrads in eyes up and to the right. The right diplopia increased in the same field. On Oct. 9, 1929, tenotomy of the right superior rectus was performed. On October 15, orthophoria in the primary position was noticed, changing to a right hypertropia of 16 centrads in eyes up and to the right and in the left hypertropia of 8 centrads in eyes down and to the right, showing now a slight paresis of the left superior rectus in addition to the inferior oblique paralysis. The patient was observed at intervals of from three to four weeks with only slight variations in the results. The condition suggests another tenotomy of the right superior rectus and a guarded tenotomy of the right inferior rectus.

DISCUSSION

DR. ARNOLD KNAPP: Will Dr. White explain to us whether an advancement of the inferior oblique is at all to be considered?

DR. JAMES W. WHITE: I have done three advancements, and I do not congratulate myself on having any result in any of the three. I have done them for congenital paralysis of the inferior oblique, and I do not think I had any result. I think I obtained all my results from the advancement of the superior rectus. One was a case of double paralysis, of both the superior rectus and the inferior oblique of the left eye, and I first advanced the inferior oblique and then the superior rectus, and the result was obtained through the superior rectus advancement.

In closing the discussion, I might add that the patient's field of diplopia, which was all over, is now limited to about less than half the field. She does not obtain diplopia now until she gets beyond the midline; to the left she has binocular single vision, and she holds that until she gets well beyond the midpoint, so that she is decidedly relieved, but not cured entirely.

INTRASCLERAL NERVE LOOPS. DR. ALGERNON B. REESE.

This paper will be published in full in a later issue of the ARCHIVES.

DISCUSSION

DR. BERNARD SAMUELS: In glancing at the patient presented by Dr. Reese, I observed on the same side, the left eye, that there are a number of large emissaria, surrounded with pigment. I examined the other eye, and could not find them. Has Dr. Reese observed in these cases of intrascleral nerve loops, that the same eyes also show very large, prominent emissaria?

DR. ALGERNON B. REESE: This feature, about which Dr. Samuels speaks, has not been observed in the other cases.

THROMBOSIS OF THE CAROTID AND MIDDLE CEREBRAL ARTERIES WITH BILATERAL HEMORRHAGIC OPTIC NEURITIS. DR. SIGMUND A. AGATSTON.

A man was admitted to the Montefiore Home with symptoms suggestive of tumor of the brain. The chief signs were hemiplegia, aphasia and blindness. Bilateral optic neuritis, differing from the ordinary choked disk by the moderate swelling, markedly dilated and thrombotic veins, and numerous peripapillary hemorrhages were present. The ophthalmoscopic picture was suggestive of venous obstruction, especially as there was a rapid loss of vision. Observations at autopsy (thrombosis of the carotid) proved the optic neuritis to be of vascular origin, evidently caused by secondary venous stasis and multiple thrombus formation.

DISCUSSION

DR. RUDOLF DENIG: Will you tell me your observations on the disk?

DR. SIGMUND AGATSTON: The disk was elevated and surrounded by hemorrhages. There was an elevation of 4 diopters, and the veins around the disk were very markedly dilated.

DR. RUDOLF DENIG: Were there thrombi?

DR. SIGMUND AGATSTON: Yes, there were.

TWO CASES OF FOREIGN BODY IN THE LENS. DR. ELIAS J. MARSH.

J. McK., a man, aged 26, was first seen on April 23, 1928, with the history that two days previously a splinter of high speed steel flew into his left eye. There was no pain, only slight irritation, which caused him to seek medical aid. Examination showed a small scar in the cornea, 2 mm. down and out from the center. A slit-lamp examination showed this to go through Descemet's membrane. Examination was otherwise negative. The vision was normal. Dilatation of the pupil with cocaine revealed a small foreign body in the lens in the vertical meridian about midway in the sagittal diameter, its track in the lens being visible backward and rather downward and inward from the wound in the anterior capsule. The Haab magnet drew the fragment forward to the anterior capsule, causing the latter to bulge strongly. It was finally drawn to below the lower pupillary area where

it has remained for more than two years, the vision still being normal. For the past two months it has become encrusted with rust. The patient will be kept under observation, no operation being performed unless some special indication arises.

W. Z., a man, aged 17, was injured two and a half months before presentation. At the time of the accident, the eyeball was collapsed, with a tension of —2. Mydriasis revealed a shiny, yellow, metallic body in the upper and outer part of the lens, measuring approximately 1 by 1.5 mm. and lying 1 mm. behind the capsule. There was a track through the lens substance reaching across from the nasal side, near the periphery to the site of the copper fragment, a small laceration being found in the swollen conjunctiva about 2 mm. from the limbus at approximately 2 o'clock. Vision allowed the fingers to be seen at 5 feet. In a few days the vision returned to 20/15, the lens had remained unchanged, and the eye was quiet. This case will also be kept under observation.

DISCUSSION

DR. BENJAMIN FRIEDMAN: It seems to me that on examining the patient with the steel fragment in the lens, there was unquestionably a brownish staining of the cornea. If this is true, what will you do with the patient?

DR. ELIAS J. MARSH: Do you mean it shows an iron staining?

DR. BENJAMIN FRIEDMAN: A brown staining on the posterior surface of the cornea.

DR. ELIAS J. MARSH: No, there was no staining anywhere, except at the site of the foreign body in the lens.

SUBHYALOID HEMORRHAGE. DR. GUERNSEY FREY.

A woman, aged 22, was first seen on April 23, 1930, complaining of blurred vision of the left eye of five days' duration. There was a history of a fall two weeks previous to presentation. The patient's general health was good. Vision in the right eye was 6/5; in the left eye, 6/9. The left fundus showed large preretinal hemorrhage, just superotemporal to the macula, with slight extravasation of blood into the surrounding tissue. The hemorrhages have since cleared up, and their site is now marked by fine white lines. Striking features of the preretinal hemorrhage were the appearance of a definite limiting membrane completely encircling the subhyaloid hemorrhage, and the presence of a distinct fluid level, which shifted with gravity on postural changes.

RATIONALE OF THE DENIG TRANSPLANT IN TRACHOMA: MICROSCOPY OF THE GRAFT IN TWO CASES. DR. BENJAMIN FRIEDMAN.

This paper will be published in full in a later issue of the ARCHIVES.

DISCUSSION

DR. RUDOLF DENIG: In my first paper, published in 1911, and also in all subsequent papers, I laid down the rule that no transplantation should be made for pannus unless complications like folliculosis, especially in its acute stage, diseased tarsus and trichiasis have been done

away with. I laid down the foregoing rule because I had found that in acute forms of folliculosis, the graft was invaded by trachomatous follicles. The same thing happened to the transplant when, as a comparatively rare occurrence, a reinfection of folliculosis took place. For this reason I recommended as far back as 1914 the use of a skin graft for such cases, knowing it to be immune to trachomatous infection. In older people, however, the epidermis has a tendency to desquamate. In some such cases I have taken the skin off again after the folliculosis was gone and the eye had become quiet and replaced it by mucous membrane from the mouth. However, I would perform skin grafting only in desperate cases of follicular reinfection, the cornea standing in immediate danger of destruction.

My present attitude toward transplantation for trachomatous pannus is the same as emphasized in 1912, and in all subsequent papers; namely, that it is for pannus occurring in the cicatricial stage of trachoma that it should be made. This kind of pannus is dangerous, and we are often helpless in coping with it. In such cases the pannus will return after periods of improvement; they end frequently in total xerosis of the cornea and the conjunctiva and transplantation is practically the only thing that saves such eyes from blindness.

Transplantation for burns of the eye should be made as soon as possible, i. e., as soon as the patient reaches the hospital, because necrosis of the sclerotica may set in soon and even in milder cases the graft may not take any more after the seventh or eighth day. Thiess of Germany, while highly pleased with early transplantation for burns, set down a number of rules as to when and under what conditions to proceed with early transplantation. I cannot agree with him, and have to insist that immediate transplantation should be done in all cases in which the cornea is affected or the conjunctiva seriously burned. In such cases transplantation is the safest, quickest and most economical kind of treatment for the patient as well as for the insurance companies. Recently I saw a case in which the temporal part of the cornea was burned last December; an immediate transplantation at that time would have cured the eye within two weeks. As it was, the patient was still under treatment five months later with a traumatic pterygium causing considerable annoyance.

Roetth of Hungary says that a number of his patients with eye burns were cured without transplantation, and if transplantation had been made in such cases, it would have been an unnecessary procedure. I am of the opinion that it is hard for the average practicing eye specialist, with a limited experience in eye burns, to decide with certainty whether or not a patient may get well without transplantation, cases of ammonia burns especially being difficult, and much valuable time may be lost by waiting, as I have seen in a case of lime burn last summer when transplantation was done on the sixteenth day; the graft did not take in its entirety, and the eye was lost, as part of the sclerotica had in the meantime become necrotic. Another argument against Roetth's view is the fact that a patient in whom a transplantation has been made at once is able to return to his work in two weeks, and if the transplantation was not made he will be out of work six weeks or more.

Since I published my last paper (Kruckenberg's Spindle, a Fusiform Pigmentation of the Cornea, ARCH. OPHTH. **1**: 590 [May] 1929),

I. Kopp of Russia (*Russk. Oftal. J.* **9**: 489, 1929) reported two cases of ammonia burns with nearly identical conjunctival and corneal symptoms (opacities and ulcerations). While the first condition, which was treated conservatively, ended with shrinking of the eyeball, the second eye in which transplantation was used became entirely well and retained normal vision.

Torpid and dystrophic processes of the cornea, sclerokeratitis and stubborn cases of herpes also yield quickly to transplantation, and last but not least, disfiguring flaps can always be removed about a year later without much trouble.

As regards the technic, I have never experienced difficulties with the suturing of the graft (see schematic drawing in my last paper). I cannot approve of Loewenstein's modification. In cases of pannus, he does not excise the conjunctiva, but simply undermines it, which by the way has been done by Mende as far back as 1913. Only in cases in which the tarsus has already been removed, and in which there may not be enough conjunctiva left for excision, should the conjunctiva be undermined, and the flap slid under it to be secured by a few sutures.

DR. DAVID WEXLER: Two years ago I was able to secure the globe of a woman 50 years of age, who nine years before presentation had a similar transplant performed by Dr. Denig for trachomatous pannus. There was a purulent conjunctivitis, but the graft was in good shape and appeared to have no follicles. After death, some of this was removed, but was unfortunately lost. Sections of the eye taken at the corneal margin show the graft overlying one limbus. The tissue of the lip is intact with its papillary structure and merges inperceptibly into the limbal stroma. There is only a slight infiltration of lymphocytes and plasma cells beneath the epithelium of the lip, hardly a follicle, while the subepithelial tissue is intact. Another section taken close to the preceding one is entirely free from infiltration. I should say, then, that this graft is well preserved after nine years.

DR. BENJAMIN FRIEDMAN: I think this is rather an important matter, because grafts are used extensively all over the world, so that any evidence which is not just right ought to be excluded. I should hesitate to say that Dr. Wexler's sections cast doubt on the efficacy of the Denig graft, because we have here a concomitant purulent ophthalmia; also the other side of the cornea showed a fair amount of infiltration, so that I should not say that the infiltration is due solely to trachoma. One must recall to mind the early observations that a superimposed purulent ophthalmia sometimes has a curative effect on trachoma; it is not unreasonable to believe that this may have happened here. I might inform Dr. Denig also that these cases had no other sequelae of trachoma in the way of trichiasis, etc., so that the graft was done in accordance with his method. In justice to Dr. Denig, clinically the patients did improve somewhat with the application of the graft.

DEMONSTRATION OF A HAND MAGNET FOR EXTRACTION OF FOREIGN BODIES FROM THE ANTERIOR CHAMBER. DR. CLYDE MCDANNALD.

This paper will be published in full in a later issue of the ARCHIVES.

CENTRAL NERVOUS SYSTEM CONTROL OF OCULAR MOVEMENTS AND DISTURBANCES OF THIS MECHANISM. DR. HENRY ALSOP RILEY.

This paper will be published in full in a later issue of the ARCHIVES.

CHANGES IN THE ANTERIOR SEGMENT IN GLIOMA. DR. GORDON M. BRUCE.

The earlier stages of glioma are well known, but later when the anterior segment is involved, the signs may be misleading. The condition may be characterized by nodular invasion of the iris, pseudohypopyon and hyphemia. The appearance in a child with a vitreous process of any of these, associated with a clear lens, should suggest the presence of glioma.

A case of glioma was reported showing a blood-stained cornea which obscured the contents of the anterior chamber.

DISCUSSION

DR. MARTIN COHEN: Have you seen any metastases? I have seen a recent case in which a diagnosis was made of glioma, only after the hemorrhage was seen in the anterior chamber; in this case we found after enucleation a nodule on the cornea which was due to a metastasis from the gliomatous mass in the vitreous.

DR. GORDON BRUCE: I did not see in the literature any reference to discrete corneal metastases.

A SIMPLE, INEXPENSIVE METHOD OF MAKING MACROSCOPIC SPECIMENS OF THE EYE. MR. E. B. BURCHELL.

After fixation and hardening, the eye is divided and the half that is selected for the macroscopic mount is placed in a modified Pick's solution for one week, which clarifies the specimen.

It is then placed in a bottle, measuring 40 mm. wide by 70 mm. high, having a wide mouth and a capacity of 55 cc. The cut surface of the specimen is held against the wall of the bottle by a celluloid strip, 65 by 32 mm., and having a circular hole 19 mm. in diameter. This hole prevents the eye from moving about in the bottle.

The bottle is then corked, with a thin, flat, three ply cork, and the cork covered with seal cap or Duco, which serves the double purpose of concealing the cork neatly, and hermetically sealing the bottle.

The method has the following advantages: 1. It is inexpensive. 2. All of the supplies are readily obtainable. 3. The specimen may be exposed to daylight without any changes or deterioration occurring in it. This is impossible with the jelly mount. 4. Should the fluid become changed in color, it can be aspirated with a spinal puncture needle and clean fluid injected with a Luer syringe, without uncapping the mount. 5. The specimen may be removed at any time, embedded and cut for microscopic examination.

AMERICAN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY

WILLIAM C. FINNOFF, M.D., *Secretary*

Eighty-First Annual Session, Detroit, June 23 to 27, 1930

THOMAS B. HOLLOWAY, M.D., *Chairman*

GONIN'S CAUTERY PUNCTURE FOR DETACHED RETINA: REPORT OF THREE CASES.

DR. ALBERT L. BROWN, Cincinnati.

The prognosis in spontaneous detachment of the retina has always been grave. Many therapeutic and operative procedures have been suggested and used. J. Gonin recently reported cases in which he attempted and in many instances succeeded in closing the retinal hole by introducing a cautery. He reported several cases in which the hole was closed by a cicatrix thus produced. He believed that the improvement is due to closure of the hole, thus preventing further seepage of vitreous fluid under the retina. In several cases he obtained reattachment with full function. He explained several failures as having been due to multiple holes or to a failure of the operative hole to close. Three cases were reported in which operation was performed by this method. In two there was a complete restoration of vision and fields. The retina in the third case attached unevenly and was grayish with no return in vision beyond light perception.

DISCUSSION

DR. SANFORD GIFFORD, Chicago: I have reviewed in detail the recent literature on ignipuncture for retinal detachment. The operation is being used extensively in Europe. I have seen it performed in a number of clinics. In general, the results are not so favorable as those reported by Gonin. Finding retinal tears and localizing them is an important factor in the procedure. Gonin has failed to find holes in but two of the cases referred to him. Vogt found holes in twenty-three of twenty-five cases; Clausen, in eleven of twelve. Indirect ophthalmoscopy is essential as most holes occur in the periphery. Gonin uses the Paquelin cautery. Most others use the electric instrument, but since the point is smaller a longer time is necessary. Several cauterizations are often necessary. In general, a fair amount of success has been obtained. The success has been much greater, however, in cases in which holes have been found. (This discussion does not lend itself to abstract and is well worth reading in the original [*Tr. Sect. Ophth., A. M. A.*, 1930]).

DR. RAYMOND SISSON, Detroit: My suggestion is that a trephine opening be used as it is much easier to work through, and in addition it will often be of advantage for drainage.

DR. E. C. ELLETT, Memphis: I have tried the Gonin operation in four cases, three of which were failures, and in one of which the patient was somewhat benefited. In no case was a tear found.

DR. GEORGE F. SUKER, Chicago: I recommend the Gonin procedure, but advise extreme caution in selecting cases for operation. I advise multiple trephine openings for the drainage of subretinal fluid.

DR. OSCAR B. NUGENT, Chicago: I should like to call attention to the use of the Gullstrand instrument, with the eyepiece removed as a help in localization.

DR. HARRY S. GRADLE, Chicago: I should like to call attention to the change in the position of the tear when the subretinal fluid is evacuated. I believe that the Paquelin cautery is to be preferred, as the larger size of the tip enables it to retain the heat better. Coagulation of the subretinal fluid helps to hold the retina in place.

OCULAR NEUROSES: AN IMPORTANT CAUSE OF SO-CALLED EYESTRAIN. DR. GEORGE S. DERBY, Boston.

Ocular neuroses are common. They are frequently not recognized and are probably less well handled than any other class of ophthalmologic case. Not only is this so, but frequently a neurosis is started or confirmed in a susceptible case by failure of the ophthalmologist to make the diagnosis and give suitable treatment. In making the diagnosis, an adequate history is most important. Time must be spent on the patient if the result is to be a success. Ocular neuroses in most instances have a favorable prognosis. In nearly all cases they may be treated successfully by the ophthalmologist. In but a few cases is a psychiatrist necessary.

DISCUSSION

This discussion does not lend itself to abstract and should be read in the original by those interested (*Tr. Sect. Ophth., A. M. A.,* 1930).

OSSEOUS TUMORS OF THE ORBIT (LANTERN DEMONSTRATION). DR. ZENAS H. ELLIS and DR. HUGH S. MCKEOWN, New York.

Bony growths within and about the orbit, though relatively frequent, have not been described completely from the ophthalmologic point of view. One case presented in this paper was an exostosis of the left orbit, producing unilateral exophthalmos with spontaneous prolapse of the globe. The second case was one with a more extensive pathologic involvement of the frontal, parietal, sphenoid and maxillary bones, producing bilateral exophthalmos.

DISCUSSION

DR. ARNOLD KNAPP, New York: Naito (Die Hyperostosen des Schädels, Vienna, J. Safar, 1924) has given us an excellent description of the cranial hyperostoses based on roentgenographic study, which was made with the supervision of A. Schüller. This author divides the hyperostoses into generalized and localized types. Acromegaly and Paget's disease are examples of the former, while the localized hyperostoses occur as osteoma, osteosarcoma and partial hyperostosis.

Bony deformities of the orbit are sometimes classified as Paget's disease. This is generally incorrect for Paget's disease (chronic osteitis deformans) shows a characteristic structural change in the cranial vault with deformity of the cranial base. The vault is enlarged by eccentric increase in thickness; it becomes balloon-shaped. The characteristic change in the bony structure is readily shown by the roentgenogram. The base of the skull presents typical changes whereby the contour is

altered. The facial bones are not involved. The clinical symptoms depend on the changes in the base of the skull which cause headache and disturbance of vision and of hearing.

In partial hyperostosis there is a diffuse involvement of individual cranial bones. This circumscribed thickening affects several bones of one side, or symmetrical parts of both sides of the skull. The striking characteristic is that the changes are localized to the anatomic limits of the individual bones. The surface is smooth, and the changes readily appear on roentgen examination. The bones involved are the superior maxilla, temporal, sphenoidal and frontal. This immediately explains the frequent involvement of the orbit, and we can divide the bony tumors of the orbit into exostoses, encapsulated osteomas and hyperostoses, following the example of W. F. Smith of Chicago, in an article which appeared in the ARCHIVES OF OPHTHALMOLOGY (**17**: 9, 1888).

I shall limit my remarks to the hyperostoses, the partial hyperostoses of Naito, as the two cases reported by Ellis and McKeown, in my opinion, belong to this variety.

I have observed three patients with partial hyperostosis: Their ages were 38, 46 and 43 years, respectively. The exophthalmos was marked, varying between 5 and 9 mm. A bony mass could be palpated within the outer bony wall. The optic nerve showed a neuritic optic atrophy. The vision was 6/9 and better. The roentgenogram demonstrated hyperostosis—increased density of the greater wing of the sphenoid and of the horizontal portion of the frontal, in all three patients. In one there was in addition a slight involvement of the malar and ethmoid regions, and in another the swelling of the outer orbital wall also extended into the temporal fossa. There was no change in the first case in six years; the second case, in which the hyperostosis was present both in the orbit and in the temporal fossa, had been followed for eight years. An operation was attempted in which the bony mass bulging into the orbit was removed. Though for a time this reduced the exophthalmos, the condition subsequently returned, and it has increased distinctly in size. I cannot but feel that the operation was ill advised and possibly increased the normal growth. The patient in the third case has only been under observation for one year.

Partial hyperostosis is a remarkable and interesting condition. The changes are definite. The underlying pathologic process is not understood. Dr. Ellis and Dr. McKeown's paper is timely. Let us hope that their plea that their contribution should stimulate further study in this subject will elicit a prompt response.

DR. GEORGE CONSTANS, Bismarck, N. D.: These growths are relatively frequent, but compared to the total number seen, true bony growths of the orbit are not common, although small growths without symptoms and in the absence of roentgen examination may easily be overlooked. Ordinarily, the diagnosis is not difficult, and roentgen examination is conclusive evidence of their presence. Ophthalmologic signs and symptoms are those common to any tumor of the orbit, and the treatment is chiefly a mechanical problem dealing with their surgical removal, often a difficult procedure.

Andrews, in 1887, reported 8 cases of bony tumors of the orbit in a series of 430,000 patients with conditions of the eye. In 1904,

LaGrange collected 148 cases as the total then reported in the literature. In a review of the literature a few years ago I found a total of 259 cases reported, including 14 cases from a series of 550,000 patients with eye diseases. I have seen another case since then without symptoms, and undoubtedly others have been reported. So we may see that these growths really form but a small part of the total number of eye conditions seen.

In a review of 418 complete reports, books and monographs on this subject in our own and in the foreign literature, the paucity of material on the etiology and pathology of these unusual growths is noted. I hope to report observations on this interesting phase later on and hope, too, that the authors will continue their work along this line.

Since the first reported cases in 1506 by Thomas Veiga, many excellent reviews and reports have been produced, among them the articles by Bornhaupst, Andrews, LaGrange, Brich-Hudifield, Knapp and many others.

I cannot agree with the essayists' mode of grouping these tumors. They are not a manifestation of Paget's disease, nor yet are they types of leontiasis ossea, but they are true bony tumors of the orbit. In grouping such tumors the hyperostoses are not true tumors but merely the result of diffuse thickening of the affected bone as in leontiasis ossea. I agree with Dr. Knapp that the reported cases fall in this group.

It is indeed confusing to review these cases as there is no standard classification. Following the work of the Committee from the American College of Surgeons on tumor classification, together with Broders' grading of malignancy, I should like tentatively to submit the following classification, the explanation and details of which will be published later:

I. Malignant bony tumors of the orbit, grade 1-4
   1. Osteogenic
   2. Metastatic—osteosarcoma only example and rare.

II. Benign
   1. Osteochrondroma
   2. Osteofibroma
   3. Hyperostoses
   4. Exostoses (endostosis of Virchow)
   5. Osteoma (encapsulated or not)
      (*a*) eburnated
      (*b*) cancellous
      (*c*) mixed

Of the true tumors such as osteomas, origin in the frontal sinus predominated, as the authors have noted.

DR. JOHN GREEN, JR., St. Louis: I wish to call attention to a paper in which I made a study of the changes in leontiasis ossea (Ocular Study of a Case of Leontiasis Ossea, *Tr. Am. Acad. Ophth.*

& Otolaryng., 1915, p. 283). The case that I reported in this paper had shown distinct improvement under mild mercurial treatment.

USE OF EPINEPHRINE IN PROGRESSIVE MYOPIA: FURTHER REPORT. DR. MEYER WIENER, St. Louis.

In 1927, it was suggested that progressive myopia might be due to a lack of secretion of the suprarenals. Reasons were given and a series of cases presented in which the treatment given was local instillation of epinephrine and the taking of strenuous exercise to stimulate the secretion of the suprarenals. In the series of ninety-nine cases presented here, seventy-nine are considered to have been checked by the treatment, and twenty continued to progress. In a few cases, especially the corneal ones, there seemed to be improvement. Most of the patients observed were of school age. They were not of the asthenic type, but were usually well rounded and plump. A study of these cases seems to show that there are a certain number in which treatment is helpful. A smaller percentage progressed regardless of treatment with epinephrine.

DISCUSSION

DR. EDWARD JACKSON, Denver: The theory of myopia, as it has been set forth by many writers, is fragmentary and many of the chief suggestions with regard to it are not sufficiently based on observation. The papers that Dr. Wiener cites on the use of epinephrine are largely based on a theory of myopia. Dr. Wiener's present paper does something more than suggest a theory. It gives statistics on the application of the method. This procedure has been tried on a certain number of eyes, and the results are reported. That control cases are not given is a serious defect. Since Dr. Wiener has given his series of cases, it remains for us to furnish controls.

In the short time before this meeting I was able to collect about ninety cases of myopia in which the patients were first seen at the age when myopia is most likely to be progressive—under 25 years of age. None of these patients was treated with epinephrine. They were all treated with glasses for full correction of the myopia, which were to be worn constantly. It is now more than thirty-five years since I read a paper before the American Ophthalmological Society, which was supplemented by a paper by the president, Dr. George C. Harlan of Philadelphia, dealing especially with cases of high myopia. My paper was on cases of myopia in which the patients were treated with glasses for full correction, which were to be worn constantly, with suspension of near work when necessary. In my own and Dr. Harlan's cases, forty in all, the result was, in nearly all, arrest of the progress of the myopia. If such a comparison can be made by the author on the necessary control cases, we will then have a basis for the estimation of the value of epinephrine in arresting the progress of myopia. All cases of myopia are progressive at some stage, but the vast majority cease to be progressive. I have seen a few cases that seemed to be congenital, but they were no exception to that statement. There is a factor somewhere that checks the progress of myopia. What that factor is, we have not the facts before us to determine fully. At this time it is reasonable to think that the endocrine secretions may furnish a control-

ling factor. The history of fetal life suggests the development of the ciliary region, and the dimensions of the eyeball make it probable that at birth there is going on a rather rapid change from hyperopia toward emmetropia, and that may go on to some extent after birth. In school children, myopia is most likely to be progressive. This is more or less connected with the use of the eyes, particularly with convergence. It is important to have definite facts presented that indicate the influence of epinephrine in the direction of checking the increasing length of the eyeball.

There is another form of progressive myopia which we might call senile myopia. In a case of such myopia with a change of almost 10 diopters, vision was lost by progressive opacity of the lens. After the cataract became complete and was removed, I found the usual refraction that is encountered in aphakia. There has been no evidence that such myopia was dependent on an increase in the anteroposterior diameter of the eyeball.

The epinephrine treatment is still "sub judice"; more facts that are closely comparable, such as those that a number of control cases can give us, are required. Like Dr. Wiener, I have not been disposed to experiment on any other line of treatment, because glasses for full correction of the myopia, when worn constantly, seem, in a large proportion of cases, to check the progress of the disease.

DR. LEO L. MAYER, Chicago: I have done some experimental work on animals with this method, a report of which will be published at some future date.

DR. E. E. BLAAUW, Buffalo: I have tried this treatment but I have not seen much result. I cannot say that I recommend vigorous treatment in the case of myopia. An endocrinologist ought to be here to discuss this paper. Under certain conditions there is an outpouring of epinephrine that has its effect over the whole body. The statement was just made that it is best for an organ to go on working. Some years ago, Gulen of Bremen stated that one should give the muscles something to do. There is no field of ophthalmology about which we talk so much, and about which we know so little. I think that it would be a fine thing if we knew more about the physiology of the eye proper; then we would have some basis on which to build. There are so many ideas about where the eye proper begins. One says it begins in the sclera, one says it begins in Descemet's membrane.

DR. HARRY S. GRADLE, Chicago: In six of thirty cases I noted no increase in the myopia. I believe that many cases of school myopia can be controlled by this method.

DR. JOHN GREEN, JR., St. Louis: I suggest that favorable results may come from a reduction of tension in the myopic eye. I have obtained reduction of tension in the glaucomatous eye with levoglaucosan, a product related to epinephrine.

DR. M. H. LEBENSOHN, Chicago: I noted progression of the myopia in only four of seventeen cases in which epinephrine was used and in them the progression was slight.

DR. M. WIENER, St. Louis: The use of the eyes in my cases was not curtailed, and all patients were given glasses for full correction.

SCHÖNLEIN-HENOCH'S PURPURA WITH INTRA-OCULAR HEMORRHAGE AND IRITIS: REPORT OF A CASE (LANTERN DEMONSTRATION). DR. WILLIAM L. BENEDICT, Rochester, Minn.

Schönlein-Henoch's purpura as a cause of acute iritis has not hitherto been reported. The disease is related to the anaphylactoid disorders associated with arthritis, abdominal pain, edema and hemorrhages into the skin. A report of a case observed over a period of ten years is presented in which intra-ocular hemorrhages occurred as a substitute for intracutaneous hemorrhage or epistaxis as vicarious menstruation. The vision of the right eye was lost, and the eye was later enucleated because of pain. The left eye was involved later, but recovery took place.

DISCUSSION

DR. LAWRENCE T. POST, St. Louis: I should like to emphasize the fact that in this entity one is dealing with a disease of the capillaries and not of the blood. Of 165 cases of purpura seen in the Barnes Hospital, probably 15 were of the Schönlein-Henoch type, and only 4 of the whole group showed a pathologic process in the eyes, and none of these was of the Schönlein-Henoch group. I wish to raise the question as to whether perhaps the iritis and keratitis in Benedict's case may not have been due to some outside cause.

DR. F. PARK LEWIS, Buffalo: I have seen but one typical case in which a boy 12 years of age lost the sight of one eye from extensive retinal hemorrhage.

DR. WILLIAM C. FINNOFF, Denver: I wish to inquire as to the presence of excessive bleeding after minor operations.

DR. WILLIAM L. BENEDICT, Rochester, Minn.: In reply to Dr. Finnoff, the bleeding time and coagulation time were normal, and there was no bleeding after surgical operations. I believe that the pains in the joints were due to hemorrhages into the synovial membranes, the abdominal pain to hemorrhages into the mesenteries. It may be that many of the hemorrhages of the eye belong in this group.

THE AGE OF PATIENTS OPERATED ON FOR SENILE CATARACT. DR. HARRY S. GRADLE, Chicago.

The age curves of 3,480 patients operated on for senile cataract by 9 different operators in various parts of the world showed surprising unanimity, the differences being practically negligible. Practically 40 per cent of all operations for senile cataract are performed between the ages of 60 and 70 years, with an average of 65. The nationality of the patients and the type of operation, whether intracapsular or extracapsular, seems to play but little rôle in the age curve.

DISCUSSION

DR. WALTER R. PARKER, Detroit: In reviewing the results in my last 600 cases, I find them practically identical with those of Gradle. I think that it is advisable to classify visual results by decades, as the younger the patient when he comes to operation, the more serious will be the average result.

METASTATIC MELANOMA OF BOTH EYES: REPORT OF A CASE. DR. FREDERICK C. CORDES AND DR. WARREN D. HORNER, San Francisco.

Metastases to the eyes from melanoma of the skin are rare and have been reported only a few times. In the case reported here a mole had been removed from the left scapular region, and a diagnosis of melanosarcoma had been made. A year later, the patient entered the hospital complaining of severe heachache. A diagnosis was made of metastatic melanoma with cerebral metastases and intracranial pressure. The patient died on the fourth day of hospitalization with diffuse pneumonia and cerebral depression. Autopsy showed metastases in the brain, heart, suprarenals and pituitary body, and sprinkled generally throughout all the organs except the liver and spleen. Both eyes contained metastases in the ciliary body, and in one eye there were small groups of tumor cells in the iris and optic nerve.

DISCUSSION

DR. MARY KNIGHT ASBURY, Cincinnati: I am interested that the location of the tumor was in the ciliary body, whereas other metastatic melanotic tumors in the literature have always been situated in the choroid.

DR. ADOLPH O. PFINGST, Louisville: I should like to call attention to the fact that very few metastatic sarcomas in the eyes have been reported, while carcinomas are relatively common. There are only about ten cases of metastatic sarcomas of the eye in the literature.

UNRECOGNIZED RETINOBLASTOMA AND PSEUDORETINOBLASTOMA: REPORT OF CASES (LANTERN DEMONSTRATION). DR. MARTIN COHEN, New York.

This article was published in full in the September, 1930, issue of the ARCHIVES, p. 368.

DISCUSSION

DR. WILLIAM ZENTMAYER, Philadelphia: I wish to emphasize the difficulty of making a differential diagnosis. Mistakes are commonplace. The personal history, the absence or presence of sequelae of inflammation, intra-ocular tension, febrile disturbance and the appearance of the child are of value in diagnosis. Children with retinoblastoma frequently have a healthy robust appearance. The loss of a useless eye cannot weigh against the danger of loss of the child.

DR. ARTHUR J. BEDELL, Albany: Retinoblastoma may be confused with angiomatosis retinae.

DR. F. H. VERHOEFF, Boston: I believe that in removing the eye the optic nerve should be severed far behind the globe; the failure to do so is responsible for many recurrences. The presence of a fibrovascular sheath of the lens may simulate this condition, and in this case the eye can be left in. With a dilated pupil, a red reflex all around the mass back of the lens is observed.

ATYPICALLY SITUATED SARCOMA OF THE CONJUNCTIVA: REPORT OF A CASE. DR. HOWARD MCI. MORTON, Minneapolis.

Melanotic sarcoma of the conjunctiva is rare. It is usually situated at the corneoscleral margin. In the case reported the tumor was unusually situated at the outer part of the bulbar conjunctiva. It was separated from the corneoscleral margin by 5 or 6 mm. Between the edge of the tumor and corneal limbus, there was a flat, elevated, colloid-looking tissue. Microscopic examination showed melanotic sarcoma. Dr. Morton reviewed the literature of sarcoma of the conjunctiva. This brings to light the unusual appearance of such growths, except at the corneal margin. He indicated the importance of x-rays and fulguration after operation. The operation, including the covering of the denuded area by Kuhnt's flaps, is described. Two other cases of sarcoma of the eye not heretofore reported are presented. The author discusses questions concerned with the return of such growths, and also the occurrence of metastasis.

TUMORS OF THE EYE AND ADNEXA (LANTERN DEMONSTRATION). DR. E. H. CARY, Dallas, Texas.

A clinical description is given of several different types of tumors, both intra-ocular and extra-ocular. As so many of the cases of glioma come to the ophthalmologist late, an attempt is made to interest the general practitioner in early diagnosis of intra-ocular tumors. Tumors are classified as they are derived and described accordingly. Attention is called to a convenient and quicker way of preparing the enucleated eye for cross-section. In cases of orbital sarcomas in which ligation and excision of the branches of the external carotid were performed, this procedure seemed of value in delaying the return of the growth. When the starvation method can be made more complete, as in sarcoma of the antrum, the procedure is of definite value.

DISCUSSION

DR. EDWARD STIEREN, Pittsburgh: I believe that melanotic sarcoma of the conjunctiva is a great clinical rarity. I have seen it but twice in about 500,000 cases; Clegg and Hall saw it 3 times in 520,000 cases. I obtained a cure by local removal in both of my cases. Flat tumors should be regarded with more suspicion than pedunculated growths.

DR. WALTER E. CAMP, Minneapolis: I wish to make a plea for a more uniform nomenclature of intra-ocular tumors. I endorse the term retinoblastoma. The less malignant pigmented growths (actually or potentially) of the uveal tract occurring in middle age should be termed malignant melanoma. The tumors rarely recur locally, but they may show metastasis up to nine or ten years after enucleation.

DR. LAURA A. LANE, Minneapolis: I have been making a study of sarcoma of the eye over a period of eight years, especially as regards those in which the patients were treated without surgical intervention, and have collected 530 cases.

DR. E. E. BLAAUW, Buffalo: I wish to call attention to the present ignorance of final results in cases of ocular sarcoma.

DR. WILLIAM H. WILDER, Chicago: I have a case in mind in which a malignant growth of the conjunctiva was definitely cured by radium.

DR. F. H. VERHOEFF, Boston: I doubt the diagnosis of neuroma and fibroma in two of Dr. Cary's cases. I believe that both were cases of glioma. After an eyeball has been removed, the presence of a tumor may be demonstrated by transillumination.

DR. HOWARD MCI. MORTON, Minneapolis: I should like to emphasize the importance of removing all possible episcleral tissue.

BACTERIUM GRANULOSIS IN TRACHOMA. DR. WILLIAM C. FINNOFF and DR. PHILLIPS THYGESON, Denver.

This paper and the discussion will appear in full in a later issue of the ARCHIVES.

TRICHINOSIS AND ITS OCULAR MANIFESTATIONS (LANTERN DEMONSTRATION). DR. LELAND F. CARTER, Detroit.

Trichinosis presents a striking and characteristic reaction in the conjunctiva of the eye. It appears as a chemosis of the bulbar conjunctiva that overlies the internal and external recti muscles. The chemosis occurs early in the disease and in about 50 per cent of the cases. A microscopic study of a *Trichina*-infested eye has shown the presence of large numbers of *Trichinella spiralis* parasites in the muscles of the eye. They were also found in several layers of the retina. The laboratory observations were of paramount value in the diagnosis of the cases presented. Eosinophilia ranging from 7 to 59 per cent extended over a period of nine months. *Trichinella spiralis* was found in the blood stream as late as the fourth week of the disease. The pitfalls in the diagnosis of trichinosis are well brought out in the case reports.

DISCUSSION

DR. E. V. L. BROWN: The ophthalmologist should be a considerable factor in the early recognition of trichinosis.

DR. F. H. VERHOEFF, Boston: I wish to call attention to the ease with which the diagnosis of trichinosis can be made from the ocular signs. I believe that the cause of the eye reaction is still not certain. Most of the cases improve.

ACUTE TUBERCULOUS IRITIS: MICROSCOPIC EXAMINATION OF AN EYE SHOWING THIS CONDITION (LANTERN DEMONSTRATION). DR. F. H. VERHOEFF, Boston.

In a patient, aged 64, with retinitis pigmentosa, blind for more than twenty years, acute fibrinous iritis, clinically similar to acute "rheumatic" iritis, developed in one eye. Roentgen examination of the chest showed marked evidences of old pulmonary tuberculosis. There was no cough or elevation of temperature. On account of pain, the eye was removed about five days after the onset of subjective symptoms. Microscopic

examination showed small recent tuberculous foci in the iris which had given rise to a fibrinous exudate in the pupil. The acute reaction may have been due to an allergic condition of the patient toward tuberculous toxins. Since the case does not conform to any type of tuberculous iritis hitherto recognized, it suggests that some, possibly many, cases of supposed "rheumatic" iritis are due to tuberculosis.

DISCUSSION

Dr. Alan Woods, Baltimore: The essential allergic reaction to infection from tubercle bacilli is acute inflammation due to the liberation of tuberculoprotein in sensitized tissues. I agree that this case probably represents an allergic reaction. (This discussion should be read in the original.)

Dr. F. H. Verhoeff, Boston: I only want to say how much I appreciate Dr. Wood's discussion and the fact that he has cleared up the matter so much better than I did in my paper. I am certainly pleased to know that he accepts my suggestion as to allergic phenomena. I am also gratified that he has been able to explain what puzzled me, namely, the absence of a great number of pus cells in the lesion.

The Eye in the Tuberculous Patient (Lantern Demonstration). Dr. Michael Goldenburg and Noah D. Fabricant, Chicago.

This article and the discussion will appear in full in a later issue of the Archives.

Chronic Anterior Uveitis: Clinical Observations Dr. M. Beigelman, Los Angeles.

The nonspecific treatment for chronic anterior uveitis in late syphilis is discussed. Contrary to Igersheimer's opinion, chronic anterior uveitis is not infrequently caused by syphilis, particularly in its late stages. In these cases, antisyphilitic treatment has little effect and best results are obtained from properly selected nonspecific agents. The author presented case histories and discussed the separation of the retina in the course of chronic anterior uveitis. Three cases of retinal detachment in the course of chronic anterior uveitis were reported. The relative importance of vitreous degeneration and of traction by organized exudate in the origin of this complication was analyzed. Transient myopia preceding the onset of chronic anterior uveitis is also mentioned. In a case of bilateral chronic anterior uveitis, in which one eye was totally blind, the onset of uveitis in the other eye was preceded by a temporary spasm of accommodation, causing myopia of —3 in the right eye. This sign is significant in the pathogenesis of chronic anterior uveitis.

Complete Bilateral Congenital Exterior Ophthalmoplegia and Double Ptosis; Bilateral Cerebral Cortical Atrophy of the Frontal and Parietal Regions (Encephalograms): A Clinical Communication. Dr. G. E. de Schweinitz, Philadelphia.

This article and the discussion will appear in full in a later issue of the Archives.

BRAIN ABSCESS: A REVIEW OF TWENTY-EIGHT CASES, WITH COMMENT ON THE OPHTHALMOLOGIC OBSERVATIONS (LANTERN DEMONSTRATION). DR. C. C. COLEMAN, Richmond, Va.

Encapsulated subcortical abscess is discussed, and diagnosis, methods of treatment and results are briefly reviewed. The main purpose of the paper is to analyze a series of twenty-eight cases, with reference to the incidence of choked disk, field defects and paralysis of the extraocular muscles.

DISCUSSION

DR. EMORY HILL, Richmond, Va.: Uhthoff found 44 per cent of swollen disks in his series of abscesses of the brain. The swelling of the optic nerve in these cases must be regarded as the result of increased intracranial pressure. Dr. Coleman's figures correspond closely with Uhthoff's. Unilateral swelling has no localizing value. There was absence of frank choking in three cerebellar abscesses. Ocular muscle palsies seem of little importance in localizing value. Ophthalmologic study proves of limited value.

DR. CHARLES E. DOWMAN, Atlanta, Ga.: Neurologic surgeons consider it a great mistake to operate on abscess of the brain before the period of encapsulation. These cases represent instances of localized suppurating encephalitis. Puncture to locate the abscess would spread the infection. At the period of encapsulation there is usually no fever and no leukocytosis.

DR. ERNEST SACHS, St. Louis: I attribute Dr. Coleman's success to three factors. He waits for encapsulation before operating. He drains through as small an opening as possible. He believes that these cases belong to the neurosurgeon rather than the otologist. The otologist, contrary to sound principles, drains through an infected mastoid wound. One should go through a potentially clean field in searching for the abscess. In certain cases aspiration alone will give good results. It may have to be repeated several times.

DR. WALTER R. PARKER: In twenty-five cases of proved abscess of the brain from Dr. Peden's service at the University of Michigan, choked disks were present in about 50 per cent. There is no definite fundus picture that will help in the diagnosis of abscess of the brain.

DR. C. C. COLEMAN, Richmond, Va.: Encapsulation takes at least three weeks. If encapsulation does not occur, the patient has no chance. In aspiration, unless a tube can be put in, another encephalitis will be brought about. With any form of operation there is always the risk of leaving a pocket undrained. Although the patients may go symptom-free for some time, the pus has not been entirely eradicated.

XANTHOMATOSIS OR LIPOID HISTIOCYTOSIS: A REPORT OF OCULAR OBSERVATIONS IN TWO CASES OF CHRISTIAN'S SYNDROME; A CORRELATION WITH OTHER OCULAR SYNDROMES (LANTERN DEMONSTRATION). DR. PARKER HEATH, Detroit.

This article and the discussion will appear in full in a later issue of the ARCHIVES.

INTRA-OCULAR BLASTOMYCOSIS (LANTERN DEMONSTRATION). DR. VIRGIL J. SCHWARTZ, Minneapolis.

This article and the discussion will appear in full in a later issue of the ARCHIVES.

GERMAN OPHTHALMOLOGICAL SOCIETY

PROF. R. SCHEERER, Tübingen, *Reporter*

Forty-Eighth Meeting, Heidelberg, June 12-14, 1930

Translated by DR. PERCY FRIDENBERG, New York

(Klin. Monatsbl. f. Augenh., July, 1930)

WHAT IS NEUTRAL LIGHT? DR. TSCHERMAK-SEYSENEGG, Prague, Czechoslovakia.

Neutral light is generally defined as mixed light of optional physical composition which not only appears colorless but also permits complete light adaptation without simultaneous color tone alteration. The physical properties were described which characterize lights that primarily, i. e., to the eye that has become neutrally adapted by the exclusion of light, appear of the original or of mixed color, whether they are homogeneous or physically composite. Special stress was laid on the characteristic primary position of the three cardinal points for basic color in the spectrum. Although different according to the type, these are individually constant, presupposing a neutral adaptation. Daylight is not suitable as a standard light on account of its high qualitative variability. It is futile to try to replace it by artificial filter light, although lamps with a predominance of short wave length light have certain practical advantages. Daylight is not chromatically neutral, as a rule, but usually causes light adaptation together with a certain amount of color tone alteration toward red-blue in cloudy weather and toward yellow-red in clear weather. Neutral light may be produced by binary or ternary combination of spectral light as well as by glass filters over undecomposed lamp light. For testing so-called colorless light as to chromatic neutrality, one may use the method of constancy of cardinal points or that of color tone-free simultaneous or subsequent reactions. The latter test is applied with invariable intensity as well as with progressive alteration of illumination. In both tests, the observations should be repeated in a certain rhythm. An apparatus for testing neutral light with spectral and glass (sic) lights is under construction.

CROSSING OF SENSORY AND MOTOR PATHS, AND CAJAL'S THEORY. DR. F. BEST, Dresden.

The fundamental idea of this view is that the reversal of the retinal image in the lens eye is responsible for the crossing of the paths in the brain. The main presupposition is that function is the determining factor for the formal topographic development of the animal body. Admitting that the double eye must function as a single organ in man and the vertebrates, it follows from the course of the fibers from the cyclopean eye that the motor path in the brain must cross, and the sensory path as well, as far as vision dominates the spatial organization of the nervous system. The special development of the visual paths follows from two further considerations: (1) the constitution of the visual field owing to stimulation in the retina and brain up to the visual sphere and (2) the application of neurobiotaxis, a procedure of the Dutch anatomist, Ariens Kappers, to the optic nerve fibers. The stimulation pattern of the visual field and retina is preserved if, with a partly combined visual field, there is total crossing instead of semi-decussation as in birds. With this slight modification, Cajal's theory remains the only logical explanation of the regular but otherwise incomprehensible crossing of the paths in the brain.

EXPERIMENTAL STUDIES OF OCULAR DIPHTHERIA AND THE EFFECT OF SERUM. DR. ELKES, Frankfurt.

Of late, diphtheria has increased in frequency and severity. Mixed infection with hemolytic streptococci, increasing the toxicity of the diphtheria germ, is considered a probable cause. In rabbits' eyes increased severity was due not to an added infection but to increased potency of the diphtheria toxin caused by the presence of the streptococcus. Diphtheria serum was found to have a marked curative action in simple and combined infections if used promptly; after two hours, it was of little use.

RELATION OF THE UVEA TO ENDOCRINE DISTURBANCES. DR. GILBERT, Hamburg.

There is a connection between disturbances of the female sexual organs and iritis. In males, vitiligo is observed with premature failure of sexual potency, and dysfunction of the thyroid and the hypophysis. Loss of pigment due to similar dyscrinisms is noted in early male castrates. Koyanagi reported from Japan many cases of deafness, alopecia and poliosis, with bilateral neuritis and uveitis, and some cases of vitiligo. Senile degeneration of the gonads may also explain the fluid vitreous found in old persons.

DYSCRINISM AND OCULAR DISEASE. DR. THIES, Dessau.

Iritis was observed with menstrual anomalies, relapsing phlyctenules and marginal corneal infiltrates, severe iritis and sequelae, disseminate choroiditis, neuroretinitis and papillitis, all affecting females,

who are ten times more susceptible to endocrine disturbances than males. The dyscrinisms were expressed as hypogenitalism, obesity and myxedema. The therapeutic effect of a proprietary female sex hormone preparation and of a preparation containing solution of pituitary was noted.

DISCUSSION

DR. MEESMANN, Berlin: It is important to make a complete clinical examination and metabolism tests, and a qualitative determination of thyroid function with the surface condensator of Gildemeister-Lueg. In a woman, aged 57, with a double nuclear cataract and myopia of 10 diopters, much fluid vitreous was lost during extraction. Iridectomy was performed; then the loop. Collapse of the globe occurred. Repeated intra-ocular hemorrhage took place from the seventh day on. Final vision was 5/5. The patient and her mother had myxedema. Abortive forms of this senile myxedema are common. In the absence of conclusive symptoms the evidence of lowered thyroid function given by the skin condensator is valuable, but does not show that the dyscrinism is an etiologic factor in cataract, as claimed by Siegrist. Even when there is apparent benefit from hormone treatment, Jess warned against attributing ocular disease to endocrine disease, as the latter is extremely common. The relation of cataract to tetany and the hypothetic disturbance of epithelial bodies has not been corroborated, although there may be some connection in congenital and infantile forms of opacity of the lens. Spontaneous opacities are noted in the eyes of young rats, much resembling those produced by experimental destruction of the epithelial bodies; these often clear up partially of their own accord.

DR. IGERSHEIMER: Endocrine seems to be the trump that is advisable to play when in doubt. There are cases of uveitis with hypophyseal disease, as well as cases of chronic arthritis deformans in elderly subjects with similar choroiditis and retinal vascular disease, which, as Lichtwitz (International Congress, Wiesbaden) showed, have a decided relationship to hypophyseal disease. In a girl, aged 13, there was a peculiar chorioretinal disease with marked adiposity and a rheumatic tendency. This suggested pituitary dysfunction, although the roentgenogram was negative.

DR. BARTELS: The factor of dyscrinism is expressed in the preponderance of female sex (four to one) among patients with tuberculous iridocyclitis, and of the male sex among those with relapsing vitreous hemorrhage (retinitis proliferans). The injection of a preparation containing solution of pituitary proved beneficial in a case of exophthalmos following removal of the thyroid gland.

DR. GILBERT: Opinions are divided, but therapeutic results are most significant, especially those shown in the Japanese literature.

DR. THIES: I advise further observation and study of dyscrinisms.

FACTORS OF ESOPHORIA AND CONVERGENT STRABISMUS. DR. W. COMBERG, Berlin.

Increased convergence in normal eyes as well as in those with squint tested by means of a Zeiss apparatus with direct reading for the

subjective and objective determination of binocular fixation is reported. Repeated examination showed that this was probably caused by the proximity of the large parts of the apparatus to one side of the eye under observation. This feeling of nearness and of the principal visual stimulus coming predominantly from one side explains the uniform results, and the discrepancy between the figures obtained with the tangent screen measurement of one eye and those found when fusion and accommodation are excluded. This disturbance of the sense of space and position is not noted in divergent squint, unless periodic, and may be slight in normal eyes with good binocular vision. One has to deal with a primary reflex searching movement of the eye with a tonic involuntary deviation as a result. The regular occurrence of this reaction suggests that it may be a factor in the causation of convergent squint and that a defect of this faculty may be associated with latent or manifest divergence.

VISION IN SQUINT AMBLYOPIA. DR. VON HOFE, Leipzig.

The young adults tested did not include myopic or markedly astigmatic or hyperopic subjects. After visual tests with the usual optotypes, it was found that visual acuity for simple forms and regular figures (quadrangle, circle, semicircle, triangle) was much higher and appeared to be aided by comparison with haptic impressions, such as the tracing of the outlines of the test figures with the pointing finger. This seems to support the view of Bielschowsky, Best and others, as to the cooperation of central factors in squint amblyopia. There is an evident disturbance of the faculty of combining impressions on which form-vision depends, aside from a lack of concentration. This is analogous to the observations in occipital injury (Goldstein, Gelb) and in congenital blindness with sight restored by operation (Uthoff, Franz, Dufour). In squint amblyopia there is a coarsening of the visual function.

DISCUSSION

DR. BEST: A homogeneously illuminated field, a nearly uniform field with few details or an iron gray field is referred (lokaliziert) not to distance but near by. Patients tend to "place" the red line of the Maddox rod at a short distance. This near sensation is due to the structure of the visual field and becomes evident with the use of various optical instruments. The closeness of the ocular eyepiece may also be a factor.

DR. TSCHERMAK: My experience of thirty years supports the view that there is a marked variability of the angle of squint as well as of the angle of an eventful sensory anomaly. This depends largely on conditions of representation (Abbildung) and conceptions of distance. The data of squint angles in binocular and monocular vision are not directly comparable. This applies particularly to phorometric measurements. It is not necessary to have recourse to internal, cerebral, inhibitory factors. Vision varies in the squinting eye as it or the other eye fixes.

DR. WECKERT: After improvement of a squinting amblyopic eye, vision increases noticeably if the test object is presented to this eye

alone, as many competing retinal points are thus eliminated. This exclusion by means of a special tin eye shade may be made permanent (demonstrated).

Dr. C. H. Sattler, Königsberg: Exclusion of the dominant eye in squint amblyopia may increase vision from 1/12 to 1/10 at a point of the retina 30 degrees from the center. It is unpardonable to fail to train the squinting eye in young children by the exclusion of the dominant fellow; even after full vision has been developed, binocular fixation must be encouraged by correcting lenses and prisms up to 20 degrees, or by suitable operation in high degrees of squint, with early stereoscopic exercises in depth perception and drawing of the object seen with the left eye on the right side (Maddox). Fusion stimulus is thus increased and a relapse into amblyopia prevented, so that finally prisms up to 40 degrees can be overcome with binocular fixation.

Dr. Comberg: The psychologic factors referred to in the discussion as hypothetic have actually been noted in practice. Thus, in women and children, especially at the beginning of the tests, one often sees a reaction of bashfulness leading to increased convergence tonus even with accurate fixation and without accommodative effort.

Chronic Myositis of the External Ocular Muscles. Dr. Meisner, Greifswald.

The clinical report and histologic specimens of two cases of exophthalmos in elderly men were presented; both patients had had an apoplectic attack on the basis of advanced arteriosclerosis and high blood pressure. All the external ocular muscles appeared thickened to three or four times the normal dimensions. Microscopically, there was evident atrophy of the muscle fibers with a relative increase in the width of the septums. Cross-sections showed marked degeneration in places, central or peripheral vacuoles, nuclear degeneration and neoformation, with a central position of the nucleus. There was marked infiltration by leukocytes and plasma cells which here and there formed foci, often enclosing blood vessels. In 1928, Cords described a similar case. This disease does not correspond to any of the forms of pseudotumors of the orbit described by Birch-Hirschfeld. In the third category with certain resemblances there is, as yet, none of the peculiar thickening and degeneration of the muscles noted.

DISCUSSION

Dr. Hessberg, Essen: I saw two cases of severe pseudotumor of the orbit with a +4 Wassermann reaction of the blood in spite of the complete absence of any signs of syphilis. At the acme of the disease the eyes appeared solidly embedded and fixed in the orbits. The disease progressed in intermittent attacks in spite of all treatment, including parenteral and malarial methods; it led to ulceration and necrosis of the cornea, with agonizing pain, which in one case necessitated exenteration of both orbits. In the other case, roentgen therapy preserved the eye, and small doses checked several later relapses. Histologic examination showed extensive periostitis and ossification of the board-like tissues without any definite microstructural changes. The thicken-

ing and increased size of the muscle substance in these cases were attributed to secondary inflammatory infiltration and not to any special condition.

DR. GILBERT: Tissue changes were observed in the orbital contents of a man, aged 49, with syphilis. Besides myositis there was marked endovascular disease, in accordance with the superficially treated syphilis. Arsphenamine and malarial therapy were of no avail in the condition of the fellow eye which yielded promptly to intensive roentgen therapy with good function in spite of exophthalmos of 19 mm. which has persisted for several years. Syphilis appears to be the important etiologic factor.

MY PRESENT TECHNIC IN GONIN'S OPERATION. DR. LINDNER, Vienna, Austria.

Methods of localizing the tear are described. At times, a preliminary puncture with the electrocautery is of service. The injection of visible fluids (fluorescein, milk) under the detached retina in order at least to determine the location of the tear has so far failed. Guist's apparatus is used for localization, and the observations are plotted on Lindner's indicator which has been improved so that its correct suturing in place is not quite sure. After the usual preparations, 1 cc. of a 2 per cent solution of procaine hydrochloride is injected into the retrobulbar tissues. After one dissects up the conjunctiva and exposes the sclera, the indicator is provisionally attached. If this is easy, the indicator is then definitely sutured in place. The sclera is marked with india ink at the point of the indicator. As many as five cautery-perforation operations were done at one time. The indicator is then removed and a provisional catgut suture is passed, encircling the future point of perforation. The electrocautery wire point is 0.4 (mm.? P.H.F.) thick, is kept in the eye for eight seconds, and is applied, in case of a very large tear, on both sides of the latter for eight seconds. The wound is then closed immediately by drawing the suture. The patient is kept in bed for eight days, and in the hospital for four weeks. As to the mode of development of detachment, the fresh, gibbous (buckelige) separation is not caused by pressure of subretinal fluid but by traction from the vitreous. A tear would ordinarily equalize inequalities of pressure but there is, furthermore, a marked absorption of fluid on the part of the choroid. Many observations show that after operation even extensive detachments disappear in a few days if the tear has been closed. The traction exerted by the vitreous is due to shrinking of this tissue. In consequence of the choroidal absorption of fluid, there is a corresponding compensatory replacement of fluid by secretion from the ciliary body with a reflux of fluid from the anterior chamber through the vitreous to the tear. This reflux would be even more marked if after an operation the point of perforation were to remain fistulous. Normal aqueous, and still more the fluid in the anterior chamber which replaces it, markedly contracts the vitreous and so brings about the detachment. Acute hypotony is the indication of an extreme degree of vitreous shrinking and occurs only in cases of large tear or fistulization at the point of operation. The accompanying iritis

may be explained as the result of the breaking down (Abbau) of the vitreous by the more highly albuminous fluid from the anterior chamber. The tear is the primary factor whether it is due to injury or to traction by vitreous opacities accompanying movements of the eye or to choroiditic changes. As soon as the choroid is laid bare, the absorption of the fluid by this tissue begins and with it the ominous reflux of fluid from the anterior chamber which causes the vitreous to shrink, more or less, depending on its structure. In the future, it may be advisable to add Deutschmann's procedure of cutting through the vitreous to Gonin's operation. In tears near the posterior pole, the electrocautery may be enclosed in an ivory sheath and, after one lays free the sclera, may be carried as far back as the optic nerve to the appropriate point for cauterization, or Guist's cautery-ophthalmoscope may be used.

DISCUSSION

Dr. Clausen, Halle: With the use of the ophthalmoscope, the meridian of the tear is carefully noted on the perimeter arc. The notation of the meridian on the cocainized eye is effected by not too minute bits of aniline pencil on diametrically opposite sides of the corneal margin with the use of a fixation ring, slightly larger in diameter than the cornea and marked off in degrees. The ophthalmoscope is again used to control the correctness of the meridian localization and to correct a possible error. The point for cauterization, the length of arc of which has previously been calculated, is visibly marked by a thread fastened around one of the little copy-pencil points at the limbus and knotted at the exact, determined distance. In this way it is easy to keep in the prolongation of the meridian plotted at the corneal margin and to mark the exact point at which to apply the cautery. The meridian is more important for ignipuncture than absolute correctness of determination of distance on the surface of the globe as the puncture opening is from 3 to 4 mm. in diameter, and if the meridian has been correctly located, even an approximately accurate localization of the tear will bring it under the influence of the cautery. Following this procedure, the tear is generally reached at the first ignipuncture. The sclera is perforated with a Graefe knife bent almost to a right angle, as advised by Vogt. The actual cautery is then carried into the vitreous and left in situ for from six to eight seconds. The scleral opening is not sutured, but the conjunctiva is carefully closed over it. Hemorrhage never occurs immediately after operation, but may come on from six to eight or even fourteen days later and markedly jeopardize success. Tears can almost always be found on careful and repeated examination; in fresh cases, practically invariably. If one fails to find the tear, rest in bed for a few days may disclose it on account of some change in the detachment. In old cases, it is sometimes impossible to find the tear. Early ignipuncture is followed by reattachment in many cases, even with myopia up to 20 diopters. In case of insufficient closure of the tear or of the appearance of another, one should not be afraid to repeat the ignipuncture, if necessary, several times. In fresh cases of detachment, no "conservative" treatment should be considered, as the earlier the ignipuncture is performed, the better the prognosis.

DR. AXENFELD, Freiburg: Ignipuncture is undoubtedly a valuable procedure, but the prognosis of detachment is not so hopeless that this operation must be advised in every case, certainly not when the course and data indicate eventual blindness. Still, in not a few cases the detachment remains partial or peripheral. It is well to watch and wait, examining the vision, field and particularly the light sense, carefully and repeatedly. Ophthalmoscopic signs of demarcation are most important. The grosser marginal changes, folds, striations and pigmentation are well known, but the earliest suggestive finer details are not always recognized. I have frequently noted and considered this fact as a command of "hands off," unless perhaps the macula is involved; in any event, one can do little harm and may even secure reattachment and regain macular function. Too little has been said of the hazards of ignipuncture. Valuable sight may be lost, and it will not console the patient to know that ignipuncture has saved others. This is not a reproach to the operation, which is like all desperate remedies. One must be courageous, but not perform ignipuncture indiscriminately in every case in which a tear is found. In this, Elschnig and Wessely agree with me. It is of the greatest practical importance to decide whether slight delay is of such great prognostic significance. The future will decide. Cases vary, and one must individualize.

DR. VON HIPPLE, Goettingen: I have had three successes in four cases. With abundant material I tried to show that spontaneous detachment was due to preretinitis producing a fine exudative membrane, which then contracted and finally tore the retina loose.

DR. VOGT: It is due much more probably to a preceding tear or hole, as Gonin and Hanssen believe.

DR. LEBER: There is support for this view in a fact that I have observed frequently in my long experience; i. e., the cover of the tear is always directed and curved, not toward the choroid, but toward the vitreous, and the margins of the tear are rolled up in the same direction, which directly proves that the retina has been torn open by a force acting from the vitreous. In 1882, I noted the constant occurrence of tears simultaneously with the detachment and at the point where it started. As far back as 1870, Wekker called attention to the invariable occurrence of spontaneous perforation, but little notice was paid to him. The broad gaping of the tear, with the margins folded outward, the frequently jagged form, the flap or strip resting on a base directed forward and often protruding far into the vitreous, without hanging loosely (flottieren), all these peculiarities indicate clearly that there is traction acting from the anterior portion of the vitreous on its inner surface.

DR. SCHREIBER, Heidelberg: I do not agree with Lindner that exact (sic) closure of the sclera is essential for the success of Gonin's operation. In experiments on rabbits in Strasbourg in 1913, I produced detachment by sucking out the vitreous; then, by sclerochoroidal trephining, producing a permanent fistula into the orbital tissues, I caused reattachment. In a few suitable cases in human beings, this procedure was found to be perfectly feasible and successful. Ohm had similar results with my operation. In a boy with myopic detachment and very large arcade-like tears, vision of 1/7 has lasted for eight years.

DR. LOEHLEIN, Jena: I prefer my procedure of flat, surface cauterization to actual puncturing of the sclera and tear which, like retinitis proliferans, presents the hazard of scar contraction with a secondary tear in a distant portion of the retina. A case of this kind is reported, which suggests caution with Gonin's operation and the necessity of following up the patients so operated on and reporting results after two or three years.

DR. AMSLER, Lausanne: As in any new operation, the technic attracts the most attention. There is danger of overproduction, as everyone is doing it now. Theoretical study and clinical recognition are at least equally important. Indications and contraindications must be studied carefully.

DR. WESSELY, Munich: Even a fine Paquelin cautery acts visibly to a depth of 3 mm.; the fine incandescent wire of the electrocautery acts only to a depth of 1 mm., as determined by experiments with animal retina covered with vitreous. Lindner's success with the comparatively delicate wire loop of the galvanocautery suggests that the action of heat on the choroid at the point of the tear and in its immediate vicinity is perhaps as important as the actual ignipuncture with the galvanocautery of Gonin.

DR. IGERSHEIMER, Frankfurt: Any operative intervention in detachment involves serious responsibility. Localization is of extreme importance and any advance in accuracy is to be welcomed. In one case with a large tear close to the nerve head accurately reached by cauterization, the detachment spread to the macula, which had not been involved previously, and vision diminished markedly. It remains to be seen whether a second operation will cause a reattachment. It is remarkable that even very extensive tears do not interfere with cure by ignipuncture. The electrocautery seems to work as well as the Paquelin cautery. The most favorable prognosis is given by peripheral tears in comparatively recent cases. What is one to do when no tear is found?

DR. VOGT, Zurich, Switzerland: As far back as about 1880, Leber mentioned tears as one of the causes of detachment, but he did not consider them an essential condition; above all, he thought that they originated from a sort of contraction process in the vitreous, with newly formed proliferations tearing the retina loose. This process as a factor in myopic and senile detachment is positively excluded by examination with the slit-lamp which, on the contrary, repeatedly shows marked fluid degeneration of the vitreous structure. It is largely composed of shreds and patches which, on movement of the eye, are thrown about with great velocity and would easily cause tears in the adjoining delicate and easily torn tissues to which they adhere. Persistent traction is made highly improbable, also, by the common observation of detachment above gradually sinking down and reattaching above. Undoubtedly, vitreous strands do occur, but in cases of long standing detachment, with secondary inflammatory changes, these bands are tough and tense and are attached to the detached retina. In these old (veraltert) cases, something may be gained by cutting through the vitreous strands. This is technically difficult, as they slip away from in front of even a sharp knife. Evidently, such strands have nothing to do with myopic detachment. My oldest cures are now of three years' standing. In

case the tear is not very large, I advise brief and gentle cauterization. Extreme heat and prolonged application or surface cauterization may greatly interfere with finding one's bearings in case a second ignipuncture operation becomes necessary, because the tear was not reached. There is another hazard, that of a secondary tear or hole formation by the ignipuncture or after it. Immediately after operation or in the course of a day or two, multiple new tears may be seen, caused not by traction but by degeneration of the retina, possibly as a result of damage to the tissue by ignipuncture; hence, the advice to be cautious with the degree and duration of heat.

Dr. Stock, Tübingen: I agree with Amsler, Gönin's assistant, as to the supreme importance of the data obtained in the preliminary examination in the prognosis. Technic is not the decisive factor. I have not changed Gonin's operation in any detail and I use the Paquelin cautery.

Dr. Jess, Giessen: In a case of ignipuncture in the neighborhood of a primary retinal tear, an extremely large, round secondary tear developed; one might have called it a circumscribed sequestrum of the retina. Probably large portions of the retina had undergone cystic degeneration and had torn through in consequence of traction by scar tissue formed by the cauterization. A slitlike tear was also noted after exploratory puncture of a previously intact retina.

Dr. Blaickner: In the localization of quite peripheral tears it is agreed that calculation of the distance of the hole from the limbus is the important point. Vogt says that the ora serrata is from 8 to 9 mm. away, but even with a pupil dilated ad maximum one does not see the ora serrata; at best one sees the equator, with the indirect image. According to Tschermak-Elschnig's calculation from the complete circumference of the globe (74 mm.), the distance from the limbus to the equator is 12.5 mm. This alone has given correct results in my cases, while the puncture on the basis of Vogt's measurements was always too peripheral. The effect of the operation depends largely on the causation of traumatic exudative fibrinous inflammation in the tissue of the choroid, which alone can cause an adhesion and reattachment of the retina. No result can be expected, and in fact none is obtained if the choroid is degenerated, atrophic or largely made up of scar tissue, even if ignipuncture is performed repeatedly and with the greatest care.

Dr. Erggelet, Jena: As both the Paquelin cautery and the galvanocautery are made of platinum, the factors of heat conduction and specific heat need not be considered. The only point is that of mass. If the heated wire loop were as large as the tip of the actual cautery, their action would be equal.

Dr. Hegner, Lucerne, Switzerland: Cases have been seen in which a cure was effected in spite of the fact that no tear was found. Two cases in which ignipuncture was performed twice, over the deepest point of detachment, yielded good result. One cannot assume a soldering together of the margins of the tear as the mechanism of healing, at least not in these two cases, and one must have recourse to Wessely's "covering" (Ueberlegung) for an explanation of these strikingly dramatic cures.

DR. LINDNER: I again warn against delay in operating. Up to the end of 1929, forty-three cases had been observed; twenty-nine with tears. Of these patients, twenty-five were operated on and eleven cured. Of fourteen fresh detachments, up to six weeks old, nine (64 per cent) were cleared up. Failure of the first operation is particularly regretable as the ignipuncture causes a certain amount of contraction of the retina and increases the danger of relapse after subsequent operations. Old detachments offer a bad prognosis because the retina has become atrophic and tears easily. The instrument mentioned by Comberg had previously been presented at the Ophthalmological Society (Vienna) but had not proved useful. The prognosis is particularly unfavorable in nonmyopic eyes and in detachment following cataract extraction. In case no tear is found, it is advisable to cauterize the entire sector of the detachment systematically in four operations. I had one case of this sort in which cure resulted.

NOTES ON SPRING CATARRH. DR. KRUECKMANN, Berlin.

In many cases, spring catarrh is to be considered as an allergic reaction. Dust was found to be the active agent in most of my cases. Phlyctenulosis is the only other manifestation of elective localized allergy affecting the ocular integument. This, however, is an endogenous bacteriotoxin process. The integument of the eye may remain refractory (sic) in disease that is "universal." The papillae are secondary and not specific and are the result of a normal (? P.H.F.) power of regeneration, which has been arrested. The hyalin, too, is a secondary manifestation caused by the presence of edema. The eosinophilia is generally a local manifestation of a general eosinophilia. In form, the mucus secreted suggests that seen in asthma. There are rudimentary forms of spring catarrh and of phlyctenulosis that are not easily accessible (? P.H.F.) clinically. Phlyctenula is to a certain degree comparable to the Pirquet reaction.

MIGRATORY TUBERCLE OF THE EYE (DEMONSTRATION). DR. A. VON SZILY, Münster.

In addition to endogenous reinfection, spreading by continuity and regional dissemination, there is a third medium of local propagation, the migratory tubercle. The flooding off and transportation of tubercle bacilli or tuberculous material by way of the lymph stream into the lymphatics and into the cavities of the eye by the intra-ocular fluids has been considered by Nuel, Straub, Gilbert, Meller, Frank and others, but little is known of the histologic details. Eyes of adolescents were shown with severe unilateral intra-ocular tuberculosis in all stages of exit (Austritt), transportation and reposition or settling down of cell groups and individual giant cells. The well known fatty precipitates (speckige Praecipitate) on the anterior surface of the lens, in the anterior chamber and on the posterior surface of the cornea (keratitis punctata) and also in the vitreous were shown to be true migratory tubercles. Gilbert had previously called attention to the tuberculous nature and structure of various "precipitates." This mode of intra-ocular dissemination seems to be the primary factor in uveal tuber-

culosis in children, the form first differentiated by Eperon, and in certain definite cases of solitary tubercle of the posterior segment.

PICTURE READING TEST TYPES FOR CHILDREN AND ILLITERATES. DR. LOEHLEIN, Jena.

My distance charts (1920) have become popular. The present series for short range testing, published by Julius Springer, Berlin, will be found particularly useful in testing the vision of children of preschool age, for the exercise of amblyopic squinting eyes, and to decide in an individual case between sending a child to an institution for the blind, or to the special classes for children with weak sight. Testing of distant vision is insufficient and picture tests are valuable, as short range vision is, after all, used preponderantly in work and play, in gaining a livelihood and obtaining an education, in all trades, industrial training, many necessary acts of daily life, and in training of manual dexterity. These pictures can be used to great advantage for testing short range vision of illiterates. The types are made by reducing my black-white distance chart figures and reproducing them in mass by long-range (kilometer) photography. The values range from 0.1 to 1, with decimal intervals, as well as much lower ones (to 0.04) for very amblyopic subjects; at the other extreme there are values of from 1.25 to 2, the limit of technical reproduction.

TEST CARD FOR READING DISTANCE. DR. HEGENER, Lucerne, Switzerland.

Most cards with a continuous text quickly become soiled and torn from constant use and the type becomes dull and faint. My card has the text, not on paper but on a photographic plate placed in a leather frame with a handle. The text is much clearer than any printed on paper. Even when highly magnified, the letters are uniformly black, show no irregularities and never become illegible. To increase the value and accuracy of this type as a visual test, capitals have been omitted. This incidentally supports the movement to do away with capitals generally. The text is calculated for a distance of 30 cm. with visual intervals corresponding to vision of 1.0—0.1

THE LIPSCHUETZ CORPUSCLES: A CONTRIBUTION TO THE MICROSCOPIC CHANGES OF THE CORNEAL EPITHELIUM IN HERPES INFECTION. DR. GRUETER, Marburg.

The bodies represent a defense reaction to the invading virus but are not a specific state. One has to do merely with a quantitative accentuation of a common biologic process in the epithelium. According to the inflammatory agent that is active, two phases are distinguished. In the first, the nucleus and its content become markedly hypertrophic. The blue (hematoxylin-eosin stain) chromatin bodies become much lighter and migrate, in part, toward the thickened and rumpled nuclear membrane. Simultaneously, two or three reddish nucleoli make their appearance. In the second phase the phenomena of hypertrophy progress in the nucleus. The latter may attain almost the diameter of a normal epithelial cell and shows hardly a trace of blue, chromatin

granules, whereas the reddish (eosinophil) nucleolus has grown enormously and shows club, egg, half-moon, polygonal and other shapes. In both stages minute red bodies are found in the protoplasm, surrounded by a clear space or halo, and having a certain resemblance to the initial stage forms of Guarnieri corpuscles. Comparative studies of catarrhal ulcer, acute eczematous corneal infiltrate, interstitial keratitis (syphilitic), acute keratitis from diphtheria toxin, chronic eczematous pannus, trachomatous pannus, as well as of noninflammatory, degenerative and mechanical diseases of the cornea, such as ribbon keratitis, keratitis neuroparalytica and the mechanical epithelial edema of glaucoma, showed, as did the epithelial cells of a lid cancroid, that all inflammatory epithelial processes in the cornea, but not the degenerative or mechanical changes, present the same picture in the individual cell, although not in the panorama of diseased tissue, as in herpes of the cornea, zoster or varicella of the skin.

SIMPLE METHOD OF LOCALIZATION OF RETINAL TEAR. DR. VON IMRE, Budapest, Hungary.

After the meridian in question is noted, a thread is passed through the limbus, exactly 90 degrees from the marked meridian. One end of the thread is passed through the aperture of the mirror (ophthalmoscopic? P.H.F.), and the other is held in the optical axis of the eye under examination. The tear is then brought into the middle of the fundus picture, and the angle presented by the two ends of the thread is measured and transferred to an instrument with an indicator giving the distance from the limbus in millimeters. This distance is then directly "applied" to the curved surface of the globe by means of a similarly curved appliance.

SIMPLE DETERMINATION AND REGISTRATION OF THE OPERATIVE POINT IN RETINAL TEAR. DR. W. COMBERG, Berlin.

Accurate ophthalmoscopic determination of the place of the tear is often useless for operation as there may be a change, amounting to several millimeters, in its relative position when the patient lies down on his back just before operation. It would be well to make measurements just at this time and under these conditions, using a very slender transilluminator carrying a needle that can be directly attached or used to mark by means of color the point from which in a definite situation the sclera was transilluminated. The quality of the glow will indicate to an experienced observer just when the point of the transilluminator is over the tear. The instrument must be rustless and easily sterilized by boiling, and the optical portion must not be of glass (? P.H.F.), so that it can be used again immediately after it has been taken out of the sterilizer. This method was suggested by a remark made by Erggelet in 1926.

QUANTITATIVE DETERMINATION OF UNILATERAL AMBLYOPIA BY MEANS OF PRISM. DR. COMBERG.

The patient fixes a black line, 0.5 cm. wide, on a white ground, 2 meters away, on a level with his eyes. A prism, base down, combined

with a strong plus glass (from 15 to 20 diopters) is then brought in front of the eye, from the side. The blurring of the image, caused by the strong convex lens, inhibits correcting readjustment of the visual axis such as would take place if the prism alone were brought in front of the eye. If the plus glass is gradually reduced to zero while the patient continues to look at the test line, one notes, in case the other eye is markedly amblyopic, that the "prism eye" soon becomes dominant and reacts with a change of position even if a plus glass is added to the prism, which makes the test line indistinct. In case the other eye is not, or only slightly, defective, one may go down to 2, 1 or 0 diopter without noting a deviation. Noting the strength of the glass that is just sufficient to elicit a correcting deviation, one can obtain a fair idea of the visual acuity of the other eye and see just what degree of vision can be obtained through this lens.

TIN EYE SHIELD FOR SQUINT AMBLYOPIA. DR. WECKERT, Goslar.

This apparatus is recommended for exclusion exercise of a strabismic eye. For limitation of the peripheral field, in order to encourage central vision and fixation in a squinting eye, a detachable tube is supplied to be slipped over the shield.

THE COURSE OF SEVERE CORROSION IN THE FIRST EIGHT DAYS. DR. THIES, Dessau.

The skin of the face, neck and breast was burned severely with soda lye. The lids and the conjunctiva of both eyes were completely necrotic, so that shreds could be picked off the surface of the globe, exposing the underlying bare white sclera. The cornea was dull and completely anesthetic. No fundus reflex was obtained. There was progressive destruction and liquefaction (Einschmelzung) of the sclera and filling up of the orbital cavity by dirty granulation tissue. A knowledge of the unfavorable course of severe corrosions is important for definite prognosis, which is always grave.

PROTECTIVE BANDAGE AFTER OPERATION FOR CATARACT; PRESUTURE NEEDLE; TESTS FOR SIMULATION. DR. ZADE, Heidelberg.

1. A starch bandage is put on the day before operation for cataract. Part of the bandage is cut out in the back so that the rest can be fastened with a roller bandage like the ordinary triangular black masks. This is preferable to Fuch's screen or Snellen's shell as it fits the patient's head accurately and is not in the way on change of dressings. 2. A presuture (vorstich) needle has been devised for use in advancement (? Vornaehung); it is shaped like a circumsuturing needle, having a point like a discission needle and thickening conically toward the other end, so that the eye with its double thread passes smoothly through the tissues without any unpleasant jerk while allowing as much scleral tissue to be taken up as is necessary for firm anchoring. It is made by Fischer Company, Freiburg. 3. Mirror tests have been devised for the detection of simulation. A revolving box is used of which the subject sees only one of the four sides. The types of the four charts appear alike and the arrangement of the test letters is about the same.

Each successive card, however, begins with a slightly smaller test letter than the preceding one. After repeated examination, in which the simulant believes that he is reading the same sized letters, exposure of the attempted deceit is simple. In another test, two mirrors are used, one 2.5 and the other 3 meters away. If the lower limit for vision in the front mirror is still maintained in the more distant glass, simulation is self-evident. No special apparatus is needed; besides, it might make the subject suspicious and antagonistic.

THE VISUAL FIELD AND THE BJERRUM SCREEN. DR. F. BEST, Dresden.

Zeiss modified his projection arrow so that it can be used with the tangent field. A bright disk, 0.5, 1 or 2 degrees in diameter, is thrown on a black or gray screen at a distance of about 1 meter. This disk may be colored red, green, blue or yellow, as desired. There is no incentive to motions of the eye except when the marker (disk) is seen in the periphery, which is the observation sought. This is much simpler than Zeeman's appliance for throwing the image of a Wolfram-arc lamp onto a campimeter screen by means of movable prisms. Ricci was one of the first to suggest projection lamps for test types of various sizes and light intensity.

PATHOLOGIC ANATOMY OF SYMPATHETIC OPHTHALMIA. DR. L. SCHREIBER, Heidelberg.

Specimens from a secondarily affected eye with sympathetic ophthalmia were shown. This material is rare, as the reports of only twenty-five cases have been collected from the literature. This was one of those unusual cases in which sympathetic ophthalmia cleared up in the injured eye with preservation of vision, whereas the sympathizing eye progressed through severe iritis with secondary glaucoma to blindness and agonizing pain which necessitated enucleation three months after the outbreak of sympathetic ophthalmia, which is comparatively soon. Histologic examination showed the rather unusual fact that only the anterior portion of the uveal tract was markedly inflamed, while the choroid was practically normal. The retina, however, showed decided signs of disease, periphlebitis and the more rare periarteritis. There was complete disappearance of the rods and cones, and advanced degenerative changes were seen in the other external layers of the retina. This is a new and significant observation in sympathetic ophthalmia, indicating that the retinal disease plays an independent part in this disease and may lead to modification of current ideas as to pathogenesis.

MULTIPLE ANNULAR OPACITIES OF THE CORNEA AFTER AN EXPLOSION. DR. KYRIELEIS, Würzburg.

The patient had been injured thirteen years previously by shrapnel. In one cornea there were two areas of opacity like cockades made up of concentric circles disposed around a central foreign body. An injury by a metallic body seemed improbable in view of the other observations, but the peculiar configuration of the opacities suggested the possibility of diffusion of some unknown chemical agent in the exploding

charge into the corneal parenchyma and a "rhythmic" precipitation or coagulation of albuminous bodies. For comparison, the speaker presented specimens of Liesegang's ring structures which are produced by diffusion of silver nitrate in bichromate gelatin, and which also are seen in animal corneas soaked in the same chemical.

CONGENITAL STAPHYLOMA. DR. MARCHESANI, Munich.

Congenital staphyloma was found in a new-born child, 40 cm. long, weighing 1,750 Gm., who died immediately after birth. Examination of the left eye disclosed a central defect of the posterior layers of the cornea, with slight ectasia of the entire cornea. There were a few anterior synechiae of the iris outside of the area of the defect. The lens was normal. There was no evidence of inflammation. The right eye showed marked total staphyloma, with a connective tissue strand extending from the middle of the posterior surface of the staphyloma to the lens which was markedly deformed, presenting as the so-called Soemmering lens-roll (Kristallwulst). The center was partially occupied by the base of the strand and in part by the folded up lens capsule. At the lower margin of the ring-roll, broken down lens masses projected; there was also a little spherical regenerated "pseudo-lens." No signs of inflammation were seen. There were accumulations of red blood cells at several points in the anterior chamber. The changes in the lens were undoubtedly secondary to a perforation of the cornea due to an extensive congenital defect of the posterior layers, progressive ectasia and staphyloma.

VON HIPPEL'S DISEASE OF THE RETINA. DR. MARCHESANI.

Case 1: In a child, aged 2½ years, a diagnosis of pseudoglioma had been made. Histologic examination showed complete strandlike (strangfoermig) detachment of the retina, thickening in its anterior portion and greenish-yellow masses of exudate containing glittering crystals between this tissue and the choroid. The optic nerve presented marked dilatation and an increase in the number of vessels to a point beyond the entrance of the arteria and vena centralis retinae. Some proliferative change in the glial tissue was seen. There were dilated vessels in the central strand of the retina. Exudate masses occurred in the external layers of the retina in the form of the well known fiber baskets (Faserkoerbe), with numerous cystic spaces that had developed out of collections of exudate. Mueller's supporting fibers were stretched and proliferated. Newly formed glia tissue was present. Protoplasmic patches or lawns (Rasen) that had undergone massive fibrillation were seen. The structural arrangement was remarkable, namely, thick bundles around the vessels and cystic spaces and in places that had been subjected to traction. There was secondary proliferation of glia. Accumulations of pigment cells were noted on the posterior surface of the retina and on the pigment-epithelium layer. Special staining showed marked fatty degeneration of these cells. The histology is that of exudative retinitis, and the condition of the optic nerve speaks in favor of primary angiomatosis.

Case 2: In a woman, aged 38, a funnel-shaped detachment was present. A large tumor-like node was found in the equatorial region. In the nerve, many newly formed (small) vessels and marked dilatation of the normal central vessels were observed. The nerve tissue had completely disappeared. There was deep glaucomatous excavation. The anterior chamber showed shallow, peripheral anterior synechiae. The vessels of the retina were greatly dilated, with thickened walls. There were many cystic formations, especially in the external retinal layers. The glia was moderately increased; the retina, on the average, was below normal in thickness. In the interior of the equatorial nodule appeared the cross-sections of a large dilated vessel with thick hyaline walls. From this (? P.H.F.) a small network of vessels proceeded which had thin walls in the central region, and thick hyaline walls in the periphery. The interspace between this capillary glomerulus (Wundernetz) was occupied by screen cells (Gitterzellen), and the entire vascular nodule was covered with a thick coating of glia tissue. The glia was very rich in fibers which ran together and formed thick ropes or braids (Zoepfe). Some glia cells had been changed into gitter cells. The glia coating contained many cystic spaces. At the posterior pole the choroid was overlaid by a thick connective-tissue brawn (Schwarte), inlaid here and there with trabeculae of bone tissue. Many epithelioid cells and dense round cell accumulations were seen in the choroid. The retina was somewhat infiltrated by fat. There was marked fatty degeneration of the choroid.

A Localization Ophthalmoscope. Dr. Guist, Vienna, Austria.

An electric ophthalmoscope sliding on a semicircular arm has been devised. The arm is attached to a ring which revolves within a second ring. The radius of both is 33 cm. The optical axis of the instrument is always pointed toward the center of the whole system. The arc is divided into 90 degrees from its center to both ends, and the large ring into 360 degrees. In the center of the semicircular arc a miniature bulb is placed for fixation. The patient's eye is placed in position by getting the entire pupil centered ophthalmoscopically, from various points. The ophthalmoscope and the large ring, which has two handles, are then shifted until the tear is covered by the spider lines (Fadenkreuz) of the ophthalmoscope. Notation is made of (1) the angle between the patient's line of fixation and the axis of the ophthalmoscope and (2) the angle formed by the plane laid between 0 and 180 degrees of the instrument, and the plane included in the position of the semicircular arm. These two angles determine the desired retinal location. The preliminary plane, from 0 to 180 degrees, is marked on the globe by sighting, with one eye held close to the fixation lamp, the (corneal) reflex image of the lamp, then stretching a thread in this plane, and putting a dot of india ink on the limbus at either end of its projection with a discission needle. From these two points the desired location is obtained by means of Lindner's diagram. The sclera can also be marked, after cocainization and dissecting up the conjunctiva, by attaching a thermocautery to the ophthalmoscope with its point corresponding to the optical axis of the latter. The cold cautery is carried underneath the conjunctiva to the back of the globe and the

latter is branded when the retinal tear appears at the center of the ophthalmoscopic field.

EXPERIMENTAL ULTRA-RED CATARACT. DR. MEESMANN, Berlin.

I used small doses of weak short wave lengths with an admixture of visible red. Irradiations of two hours, totaling 160 hours, and extending over a year were used. A cataract was produced in six rabbit eyes; the first opacities appeared, on an average, after 30 irradiations in 4 months, and were located invariably in the posterior horizontal suture with a fine feathery distribution corresponding to the ending of the lens fibers in the "star." In one case there was a less characteristic opacity in the anterior vertical suture; in another case, in addition to the posterior suture opacity, irregular white wreaths of opacity with a surrounding veil were seen directly under the anterior capsule. In one case there was a sector-shaped opacity with large water clefts, surrounding the equator, which manifestly belonged to the first zone of discontinuity. The pathogenesis of this condition, like that of radium cataract, seems to be due to a disturbance of metabolism, with an increase of oxidation processes, resulting finally in the breaking down of the ends of the lens fibers which are farthest removed from the cell nucleus.

(To be continued)

Book Reviews

KURZES HANDBUCH DER OPHTHALMOLOGIE. Edited by PROF. F. SCHIECK, Würzburger, and PROF. A. BRÜCKNER, Bâle. Seven volumes. Berlin, Julius Springer, 1930.

To supply the information that is not contained in the textbooks on ophthalmology without the time and labor required to study the large systems and encyclopedias, the editors believe that this publication, limited to seven volumes, will fill a definite void. Literary references have been restricted, and theoretical discussions avoided. At the same time each subject receives a complete survey, and close relation to contiguous branches is stressed. The entire work is to be completed before the end of 1932, and the price is not to exceed 1,000 marks. Each volume can be bought separately. The following two volumes have appeared:

Volume I: Anatomy, Embryology, Malformations, Hereditary Diseases. Price, 134 marks. Pp. 900, with 432 illustrations, some in color.

This volume consists of: Anatomy of the Human Eye, by Prof. P. Eisler, Halle, a. S.; The Connection of the Eye and the Central Nervous System, by Prof. R. A. Pfeifer, Leipsic; The Development of the Human Eye, by Prof. R. Seefelder, Innsbruck; The Deformities of the Human Eye, by Prof. R. Seefelder, Innsbruck, and Hereditary Eye Diseases, by Dr. A. Franceschetti, Bâle.

The first part comprises 472 pages and takes up the orbit, the eyeball with its various structures, the muscles, eyelids and lacrimal organs, the vessels and nerves of the eye and the literary references. The second part deals with the nervous connections, the optic tracts, the cerebral course of the oculomotor nerves and the relation to the sympathetic nervous system and literary references. The illustrations are unusually well chosen; while a few of the usual diagrams are included, there are many that are new and instructive, such as the elastic fibers in the pectinate ligament, page 101; the layers of the retina, pages 119 and 123; the framework of the vitreous, page 163; the inner wall of the orbit, page 250; the nerves of the orbit and their intracranial course, page 302, and the relation of the chiasm to the sella turcica (from Schaeffer), page 345.

The part on the connection of the eye with the central nervous organ is the work of the well known neuro-anatomist, R. A. Pfeifer. The subject (*A*) optic path from the chiasm up and (*B*) oculomotor nerves in their intracranial course is well illustrated by many brain sections, schematic and wax-plate reconstruction method models.

The section on embryology of the eye is from the pen of the well known scientist Seefelder and occupies 100 pages; the malformations are treated in 100 pages. These subjects are well illustrated by excellent and clear illustrations, many in color. The second part takes up the various colobomas and congenital deformities; the literary references occupy twenty pages.

Finally, hereditary lesions, discussed by Franceschetti, are considered along hereditobiologic lines and the laws of heredity. In the special part the hereditary anomalies of each part are taken up with an appended literary review. A general author's and subject index concludes the volume.

A perusal of this volume of what is called a "short" handbook shows that the term is only relative, as the subjects are completely treated, and it would be difficult to find anything that has been omitted. It is an imposing and stupendous undertaking and reflects great credit on German ophthalmology. It will be of great value to all workers in this field, though its cost may be a bar to general purchase.

Volume V: Uvea, Lens, Vitreous, Retina, Papilla and Optic Nerve. Price, 134 marks. Pp. 774, with 466 illustrations, mostly in color.

The contents of this volume include: Diseases of the Uvea, by Prof. W. Gilbert, Hamburg; The Lens, by Prof. A. Jess, Giessen; The Vitreous, by Prof. A. Jess, Giessen; The Retina, by Prof. F. Schieck, Würzburg, and The Optic Nerve, by Dr. Henning Ronne, Copenhagen.

The subject of diseases of the uvea is treated in 170 pages with literary references at the end of each chapter. The author, Professor Gilbert, is known by his contributions to this chapter of ophthalmology and particularly by the clinical picture of "recurring iritis with hypopyon." First come diseases of the iris and of the ciliary body. The diseases of the iris are divided, as is customary for German systematic writers, into the diffuse and circumscribed forms. Focal infections are recognized, and their importance in the etiology of the so-called rheumatic iritis is emphasized. The subject of tuberculous iritis is thoroughly gone into from every standpoint. The author regards the subcutaneous tuberculin test as the best but cautions against its careless use, and lays stress on the roentgen examination of the chest. After the inflammatory lesions, tumors and cysts of the iris and ciliary body are discussed; then the diseases, tumors, detachments and injuries of the choroid are described. The discussion of this entire subject is greatly enhanced by many illustrations in color.

Professor Jess, the author of the part on the lens, is well known by his research in the chemical changes in the cataractous lens. The subject is treated in 110 pages. After a brief anatomic introduction the congenital lenticular opacities are first described. In addition to the usual forms, this writer speaks of a central cataract. The appearance of the acquired opacities and their anatomy, chemistry, pathogenesis and medicinal treatment are fully taken up. All forms of acquired cataract are then described, including secondary cataract and the cataract occurring in diabetes, tetany and myotonic dystrophy. Finally, lesions from trauma or dislocations complete a creditably written, beautifully illustrated and instructive chapter.

The same author deals with the vitreous body, giving a description of the anatomy and physiology, then of what is known about its diseases, a truly difficult chapter.

Professor Schieck, one of the editors of the Handbook and well known for his contributions to ocular immunology, papilledema and retinal lesions in nephritis and hypertension, treats the subject of

retinal diseases. This occupies 230 pages and its consideration springs from sound and scientific deductions of general pathology. After an anatomic introduction, the anomalies of the central retinal vessels are first described; then follow diseases of the retina in nephritis and hypertension, in diabetes, detachment of the retina, progressive retinal atrophy (pigmentosa, etc.), hemeralopia, infective processes (tuberculous, syphilitic, metastatic, septic), retinal lesions located at the macula (hereditodegenerative), disk-shaped degeneration, etc., and finally tumors (glioma) and angiomatosis. The text contains many illustrations in color, so that this is really an opthalmoscopic atlas.

The diseases of the papilla and optic nerve up to the chiasm are entrusted to Henning Ronne, who is well known for many important contributions to ophthalmology. The subject occupies 150 pages. In diseases of the papilla the author first describes the picture seen with the ophthalmoscope of the disk, its vascular peculiarities, abnormal functions (pigment, drusen), excavation, pseudoretinitis, tumors and tuberculosis. In the part on diseases of the optic nerve optic neuritis and papilledema are first considered, with a description of their appearance, symptoms and occurrence in cerebral hemorrhage and other cerebral lesions, and in infectious diseases, nephritis and injuries. A chapter is devoted to retrobulbar neuritis and another to optic atrophy. The text is fully illustrated with pictures of the fundus, histologic drawings and fields of vision.

The four parts of this volume are alike in the excellency of their representation, reflecting the greatest credit on their authors. They should be of the greatest help to the advanced ophthalmologist.

A. K.

SAMMLUNG STEREOSKOPISCHER BILDER VON AUGENKRANKHEITEN. By DR. A. V. RÖTTH. With an introduction by PROF. J. IMRE. JR. Price, 20 marks. Berlin, A. Hirschwald, 1929.

The author has collected monochromatic stereoscopic photographs of important clinical cases for illustration and for teaching purposes. This is the first of three parts. The pictures are made with the Druner camera; the illumination is an arc-light projection lamp, of 35 amperes 110 volts. The glare is irritating to inflamed eyes, but is relieved by the use of corodemin drops. This series consists of fifty pictures. An accompanying text is in German, English and Hungarian. The subjects include: conjunctiva: trachoma, posterior symblepharon, gonorrheal conjunctivitis, tuberculosis of the conjunctiva, erythema nodosum, lymphoma, papilloma, carcinoma, cyst, epitarsus, pterygium, xerosis and nevus flammeus and glaucoma; cornea: catarrh, ulcer, serpent ulcer, adherent leukoma, keratomycosis, pannus, applanatio, pseudopterygium, rosacea, disciform, parenchymatous (due to syphilis and tuberculosis) megalocornea; iris: acute iritis, tuberculosis, seclusio, dyschromasia, coloboma; cataract: incipient, hypermature, mature, anterior polar, zonular, posterior, cortical; foreign body: contusion, iridodialysis, cataracta secundaria, perforating wound, burn, vaccinia of lid, carcinoma of lid, cyst at external canthus.

The photographs are excellent, and the subjects are well chosen. They serve their purpose and will be of value for instruction and teaching.

A. K.

Directory of Ophthalmologic Societies *

FOREIGN

Oxford Ophthalmological Congress

Master: Dr. A. B. Cridland, Salisbury House, Chapel Ash, Wolverhampton, England.
Secretary: Dr. C. G. Russ-Wood, 12 St. John's Hill, Shrewsbury, England.

NATIONAL

American Medical Association, Section on Ophthalmology

Chairman: Dr. George F. Suker, 25 E. Washington St., Chicago.
Secretary: Dr. William C. Finnoff, Imperial Bldg., Denver.
Place: Philadelphia. Time: 1931.

American Academy of Ophthalmology and Oto-Laryngology

President: Dr. William H. Wilder, 122 S. Michigan Ave., Chicago.
President-Elect: Dr. J. F. Barnhill, Miami Beach, Fla.
Executive Secretary: Dr. William P. Wherry, Medical Arts Bldg., Omaha.
Place: Chicago. Time: October 27-31, 1930.

American Ophthalmological Society

President: Dr. Edward C. Ellett, Exchange Bldg., Memphis, Tenn.
Secretary: Dr. Emory Hill, Professional Bldg., Richmond, Va.

SECTIONAL

New England Ophthalmological Society

President: Dr. S. Judd Beach, 704 Congress St., Portland, Me.
Secretary-Treasurer: Dr. E. B. Dunphy, 520 Commonwealth Ave., Boston.
Place: Massachusetts Eye and Ear Infirmary, 243 Charles St., Boston. Time: 8 p. m., third Tuesday of each month from November to April, inclusive.

Pacific Coast Oto-Ophthalmological Society

President: Dr. Chester H. Bowers, 1136 W. 6th St., Los Angeles.
Secretary-Treasurer: Dr. Walter F. Hoffman, 817 Summit Ave., Seattle.

Puget Sound Academy of Ophthalmology and Oto-Laryngology

President: Dr. Walter F. Hoffman, 817 Summit Ave., Seattle.
Secretary-Treasurer: Dr. Francis A. Brugman, Medical-Dental Bldg., Seattle.
Time: 8 p. m., third Tuesday of each month, except July and August.

Southern Medical Association, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Fred Hasty, 119 Seventh Ave., Nashville, Tenn.
Secretary: Dr. Fletcher D. Woodward, Box 162, University, Va.
Place: Louisville, Ky. Time: November, 1930.

---

* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

SOUTHWESTERN MICHIGAN TRIOLOGICAL SOCIETY

President: Dr. Wilfrid Haughey, 65 W. Michigan Ave., Battle Creek.
Secretary: Dr. R. H. Fraser, Battle Creek Sanitarium, Battle Creek.
Time: Third Thursday of alternate months.

STATE

COLORADO OPHTHALMOLOGICAL SOCIETY

President: A presiding officer is selected for each meeting alternately until all members have served.
Secretary: Dr. Donald H. O'Rourke, 217 Imperial Bldg., Denver.
Place: First floor, Metropolitan Building, Denver. Time: 7:30 p. m., third Saturday of the month, October to April, inclusive.

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON EYE, EAR, NOSE AND THROAT

President: Dr. Dorland Smith, 836 Myrtle Ave., Bridgeport.
Secretary-Treasurer: Dr. Walter L. Hogan, 750 Main St., Hartford.
Time: May, November.

EYE, EAR, NOSE AND THROAT CLUB OF GEORGIA

President: W. L. McDougall, 50 Whitehall St., S. W., Atlanta.
Secretary-Treasurer: Dr. William O. Martin, Jr., 412 Medical Arts, Bldg., Atlanta.

INDIANA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. H. A. Van Osdol, 320 N. Meridian St., Indianapolis.
Secretary: Dr. Robert J. Masters, 23 E. Ohio St., Indianapolis.
Place: Indianapolis. Time: December 10 and 11, 1930.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. John C. Brown, 350 St. Peter St., St. Paul.
Secretary-Treasurer: Dr. J. H. Morse, 2511 Washburn Ave., S., Minneapolis.

MONTANA ACADEMY OF OTO-OPHTHALMOLOGY

President: Dr. Lee W. Smith, 125 W. Granite St., Butte.
Secretary: Dr. J. G. Parsons, Lewistown.

NORTH DAKOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. H. B. Beeson, 232 W. De Mers Ave., Grand Forks.
Secretary-Treasurer: Dr. F. L. Wicks, Valley City.

OREGON ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. J. W. McCollom, 346½ Washington St., Portland.
Secretary-Treasurer: Dr. Andrew J. Browning, 418 Mayer Bldg., Portland.
Place: Good Samaritan Hospital. Time: Third Tuesday of each month.

RHODE ISLAND OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY

President: Dr. Raymond F. Hacking, 105 Waterman St., Providence, R. I.
Secretary: Dr. Herman A. Winkler, 224 Thayer St., Providence, R. I.
Place: Rhode Island Medical Library. Time: 8:30 p. m., second Thursday in October, December, February and April.

UTAH OPHTHALMOLOGICAL SOCIETY

President: Dr. Franklin H. Raley, 9 Exchange Pl., Salt Lake City.
Secretary-Treasurer: Dr. H. Leroy Smith, 1005 Medical Arts Bldg., Salt Lake City.

VIRGINIA SOCIETY OF OTO-LARYNGOLOGY AND OPHTHALMOLOGY

Secretary-Treasurer: Dr. Henry Grant Preston, Harrisonburg.
President: Dr. Fletcher D. Woodward, Box 162, University.

LOCAL

Academy of Medicine of Northern New Jersey, Section on Eye, Ear, Nose and Throat

Chairman: Dr. J. Wallace Hurff, 86 Washington St., Newark.
Secretary: Dr. Earl LeRoy Wood, 31 Lincoln Park, Newark.
Place: 91 Lincoln Park South. Time: 8:45 p. m., second Monday of each month.

Academy of Medicine of Toronto, Section of Ophthalmology

Chairman: Dr. Louis Joseph Sebert, 86 Bloor St., W., Toronto.
Secretary: Dr. Alexander E. MacDonald, 151 Bloor St., W., Toronto.
Time: First Monday of winter months.

Atlanta Academy of Ophthalmology and Oto-Laryngology

President: Dr. William L. McDougall, Atlantic National Bank Bldg., Atlanta, Ga.
Secretary: Dr. William O. Martin, Jr., 384 Peachtree St., Atlanta, Ga.
Place: Academy of Medicine, 38 Prescott St., N. E. Time: 8 p. m., last Thursday of each month.

Baltimore Medical Society, Section on Ophthalmology

Chairman: Dr. Leo J. Goldbach, 1012 N. Charles St., Baltimore.
Secretary: Dr. Angus Lloyd MacLean, Johns Hopkins Hospital, Baltimore.
Place: Medical and Chirurgical Faculty, 1211 Cathedral St. Time: 8:30 p. m., fourth Thursday of each month from October to May.

Brooklyn Ophthalmological Society

President: Dr. John N. Evans, 23 Schermerhorn St., Brooklyn.
Secretary: Dr. Michael J. Buonaguro, 589 Lorimer St., Brooklyn.
Place: Kings County Medical Society Bldg., 1313 Bedford Ave. Time: Third Thursday of February, April, May, October and December.

Buffalo Ophthalmologic Club

President: Dr. A. F. Luhr, 40 W. North Ave., Buffalo.
Secretary-Treasurer: Dr. Thurber Le-Win, 112 Linwood Ave., Buffalo.

Chicago Ophthalmological Society

President: Dr. Harry S. Gradle, 58 E. Washington St., Chicago.
Secretary: Dr. Richard C. Gamble, 30 N. Michigan Ave., Chicago.
Place: Medical and Dental Arts Club. Time: Third Monday from October to May.

Cleveland Academy of Medicine, Section of Ophthalmology and Oto-Laryngology

Chairman: Dr. M. Paul Motto, Rose Bldg., Cleveland.
Secretary: Dr. A. D. Ruedemans, Euclid and E. 93d St., Cleveland.
Place: Winton Hotel. Time: Fourth Friday of each month.

Cleveland Ophthalmological Club

Chairman: Dr. W. E. Burner, Guardian Bldg., Cleveland.
Secretary: Dr. M. P. Motto, Rose Bldg., Cleveland.

College of Physicians, Philadelphia, Section on Ophthalmology

Chairman: Dr. Maxwell Langdon, 1530 Locust St., Philadelphia.
Clerk: Dr. Alexander G. Fewell, 1924 Pine St., Philadelphia.
Time: Third Thursday of every month from October to April, inclusive.

Columbus Ophthalmological and Otolaryngological Society

Chairman: Dr. A. M. Hauer, 327 E. State St., Columbus, Ohio.
Secretary-Treasurer: Dr. Albert D. Frost, 681 E. Broad St., Columbus, Ohio.
Time: First Monday of each month.

Dallas Academy of Ophthalmology and Oto-Laryngology

President: Dr. H. B. Decherd, 1717 Pacific Ave., Dallas, Texas.
Executive Secretary: Dr. W. Mood Knowles, 1717 Pacific Ave., Dallas, Texas.
Place: Dallas Athletic Club. Time: 6 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

Detroit Ophthalmological Club

Chairman: Members rotate alphabetically.
Secretary: Dr. Parker Heath, David Whitney Bldg., Detroit.
Time: 6:30 p. m., first Wednesday of each month.

Eastern New York Eye, Ear, Nose and Throat Association

President: Dr. G. G. Marshall, 122 West St., Rutland, Vt.
Secretary-Treasurer: Dr. Arthur F. Holding, 142 Washington Ave., Albany.
Time: Third Wednesday of October, November, March, April, May and June.

Fort Worth Eye, Ear, Nose and Throat Society

President: Dr. W. R. Thompson, 510 Main St., Fort Worth, Texas.
Secretary-Treasurer: Dr. R. H. Needham, Fort Worth National Bank Bldg., Fort Worth, Texas.
Place: University Club. Time: 6:30 p. m., first Friday of each month except July and August.

Houston Academy of Medicine, Eye, Ear, Nose and Throat Section

President: Dr. Claude C. Cody, 1306 Walker Ave., Houston, Texas.
Secretary: Dr. J. M. Robison, Eye, Ear, Nose and Throat Hospital, Houston, Texas.
Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., first Thursday of each month from September to June.

Indianapolis Ophthalmological and Oto-Laryngological Society

President: Dr. E. L. Lingeman, 241 N. Pennsylvania St., Indianapolis.
Secretary: Dr. Kenneth L. Craft, Hume-Mansur Bldg., Indianapolis.
Place: University Club. Time: 6:30 p. m., second Thursday of each month from October to May.

Kansas City Society of Ophthalmology and Otolaryngology

President: Dr. A. E. Eubank, Argyle Bldg., Kansas City, Mo.
Secretary: Dr. O. S. Gilliland, Professional Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work.

Long Beach Eye, Ear, Nose and Throat Society

President: Dr. Dean E. Godwin, Security Bldg., Long Beach, Calif.
Secretary-Treasurer: Dr. Ferris Arnold, Security Bldg., Long Beach, Calif.
Place: Pacific Coast Club. Time: Last Wednesday of each month from September to June.

Los Angeles County Medical Society, Section on Ophthalmology and Otolaryngology

President: Dr. A. Ray Irvine, 727 W. 7th St., Los Angeles.
Secretary-Treasurer: Dr. J. Frank Friesen, 727 W. 7th St., Los Angeles.
Place: California Lutheran Hospital, Assembly Room. Time: 8 p. m., first Monday of each month.

Medical Society of the District of Columbia, Section of Ophthalmology and Oto-Laryngology

Chairman: Dr. James A. Flynn, 1511 Rhode Island Ave., Washington.
Secretary: Dr. E. R. Gookin, Medical Science Bldg., Washington.
Place: 1718 M St. N. W. Time: 8 p. m., third Friday of each month.

Memphis Society of Ophthalmology and Oto-Laryngology

Chairman: Each member, in alphabetical order.
Secretary: Dr. R. O. Rychener, Exchange Bldg., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

Milwaukee Oto-Ophthalmic Society

President: Dr. Edward R. Ryan, 425 E. Water St., Milwaukee.
Secretary-Treasurer: Dr. O. P. Schoofs, 120 E. Wisconsin Ave., Milwaukee.
Place: University Club. Time: 6:30 p. m., third Tuesday of each month.

Nashville Academy of Ophthalmology and Otolaryngology

Chairman: Dr. R. J. Warner, 706 Church St., Nashville, Tenn.
Secretary-Treasurer: Dr. W. W. Wilkerson, Jr., Bennie-Dillon Bldg., Nashville, Tenn.
Place: St. Thomas Hospital. Time: 8 p. m., third Monday of each month.

New Orleans Ophthalmological and Otological Society

President: Dr. W. A. Wagner, Pere Marquette Bldg., New Orleans.
Secretary-Treasurer: Dr. M. F. Meyer, Canal Bank Bldg., New Orleans.
Place: Eye, Ear, Nose and Throat Hospital. Time: Third Thursday of each month from October to June.

New York Academy of Medicine, Section of Ophthalmology

Chairman: Dr. E. F. Krug, 12 W. 44th St., New York.
Secretary: Dr. William F. C. Steinbugler, 815 Park Ave., New York.
Time: 8:30 p. m., third Monday of every month from October to May, inclusive.

Omaha and Council Bluffs Ophthalmological and Otolaryngological Society

President: Dr. George B. Potter, 107 S. 17th St., Omaha.
Secretary-Treasurer: Dr. J. C. Davis, 425 Aquila Court, Omaha.
Place: Medical Tea Room. Time: 5:15 and 7:00 p. m., third Wednesday of each month from October to May.

Pittsburgh Ophthalmological Society

President: Dr. Edward B. Heckel, Jenkins Arcade Bldg., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: Pittsburgh Academy of Medicine Bldg. Time: Fourth Monday of each month, except June, July, August and September.

Pittsburgh Slit-Lamp Society

President: Dr. W. W. Blair, 121 University Pl., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: 121 University Pl. Time: Second Monday evening of every month, except June, July, August and September.

Rochester Eye, Ear, Nose and Throat Society

Chairman: Dr. A. Vincent Walker, 833 South Ave., Rochester, N. Y.
Secretary-Treasurer: Dr. John F. Gipner, 53 Fitzhugh St., Rochester, N. Y.
Place: Rochester Medical Assn., 113 Prince St. Time: 8 p. m., third Monday of each month from October to May.

St. Louis Ophthalmic Society

President: Dr. Charles W. Tooker, 308 N. 6th St., St. Louis.
Secretary: Dr. Carl T. Eber, 1006 Carleton Bldg., St. Louis.
Place: St. Louis or Washington University Cafeteria.
Time: 6:30 p. m., fourth Friday of each month from October to April, inclusive.

San Antonio Ophthalmolo-Oto-Laryngological Society

President: Dr. F. W. Sorrell, Gibbs Bldg., San Antonio, Texas.
Secretary-Treasurer: Dr. A. F. Clark, 728 Main Ave., San Antonio, Texas.
Place: Bexar County Medical Library. Time: 8 p. m., first Tuesday of each month from October to May.

Spokane Academy of Ophthalmology and Otolaryngology

President: Dr. A. N. Codd, 421 W. Riverside Ave., Spokane, Wash.
Secretary: Dr. Marc Anthony, Old National Bank Bldg., Spokane, Wash.

Syracuse Eye, Ear, Nose and Throat Society

President: Dr. Searle B. Marlow, State Tower Bldg., Syracuse, N. Y.
Secretary-Treasurer: Dr. A. Harry Rubenstein, Medical Arts Bldg., Syracuse, N. Y.
Place: University Club. Time: Second Friday of each month except June, July and August.